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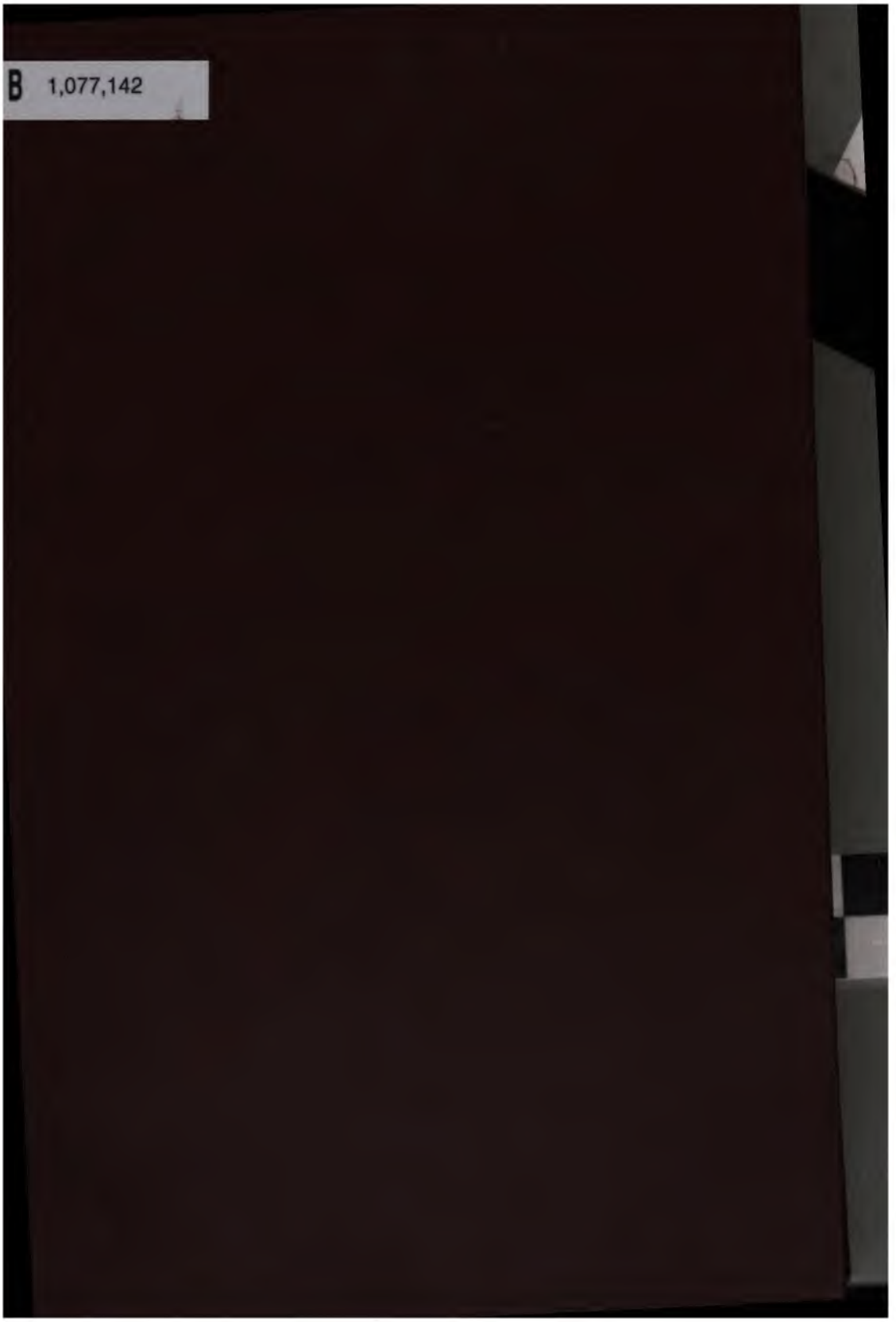
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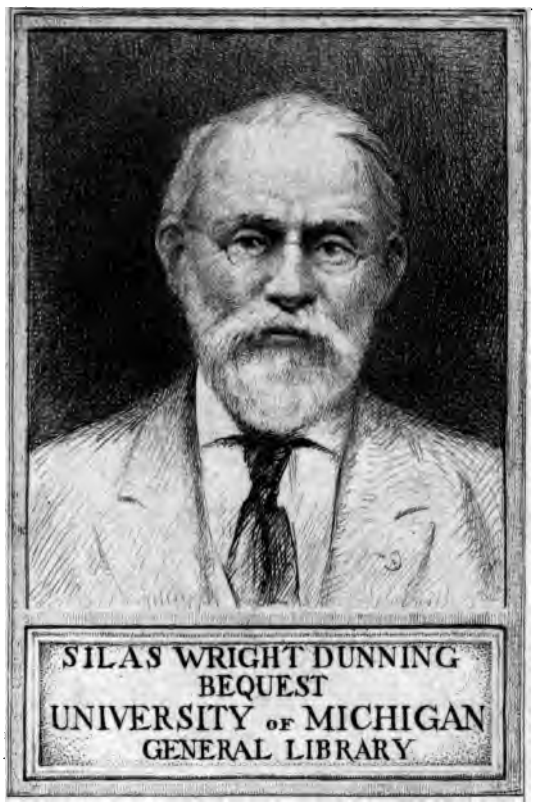

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TRANSACTIONS

OF THE

BOMBAY GEOGRAPHICAL SOCIETY,

FROM SEPTEMBER 1850 TO JUNE 1852.

EDITED BY THE SECRETARY.

VOLUME X.

BOMBAY:

PRINTED AT THE "TIMES" PRESS,

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MDCCCLII.

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ERRATA.

The plates will be stitched in at the end of the number beginning with plate IV. The first three illustrations meant to have preceded these have been withheld—as the amount of drawings threatened thereby to become too numerous—the preparation of those now inserted having preceded that of those intended to have been so, but now omitted.

For the preparation of all the Barometric and other tables I am indebted to the industry and indefatigable zeal of Mr. Mayes, late of the Aden Observatory, now engaged in passing his former observations through the press at Bombay.

The following Errata require to be corrected in Lieut. Raverty's paper.

Page— 2 Note, 2nd line from bottom, for Ah! read *Oh!*
" — 2 4th line from bottom, for Ah! read *Oh!*
" — 8 14th line from bottom, for Shaimvarees read *Shainwarees.*
" — 8 9th line from bottom, for Teman read *Leman.*
" —11 16th line from top, for Kuzzulbash read *Kuzzilbash.*
" —16 7th line from top, for Abreshurtaroosh read *Abreshm Farosh.*
" —16 10th line from top, for Bazaran read *Bazazan.*
" —17 17th line from top, for gram read *grain.*
" —17 1st line from bottom, for Baukers read *Bakers.*
" —17 6th line from bottom, for Share read *Shair.*
" —18 9th line from top, for Bazaran read *Bazazan.*
" —18 14th line from top, for Deealers read *Dealers.*
" —18 14th line from bottom, for Kazir Kalan read *Kagiz Koban.*
" —18 10th line from bottom, for Kafshdar read *Kafshdoz.*
" —18 9th line from bottom, for Bazaran read *Bazazan.*
" —19 18th line from top, for Nam read *Nan.*
" —19 8th line from bottom, for Keerumpurah read *Kurreempurah.*
" —19 10th line from bottom, for Gunj-i-Khonahar read *Gunjikhonah or.*
" —20 7th line from top, for Kaharan read *Kakkaran.*
" —20 10th line from top, after Peshawur add the words " are the Hummams or Hot-Baths."
Page—20 5th line from bottom, for operated on read *operated-on.*
" —22 6th line from bottom, for Jun read *Inn.*
" —23 18th line from bottom, for Jahafan read *Sahafan.*
" —25 15th line from top, for Shalah read *Shælah.*
" —25 13th line from bottom, for was read *is.*
" —26 8th line from top, for Daondzai read *Daoudzai.*
" —27 5th line from top, for Derauj read *Deraiy.*
" —27 12th line from top, for Fackeer read *Fuckyeer.*
" —28 1st line at top, for Luddah read *Suddah.*
" —29 21st line from top, for Daondzais read *Daoudzais.*
" —29 21st line from top, for Hindkeels read *Hindkhees.*
" —30 9th line from top, for Lerbulunderpur read *Surbulunderpur.*
—30 11th line from top, for Daondzai read *Daoudzai.*
" —30 18th line from top, for Daondzai read *Daoudzai.*

Page—31 17th line from bottom, for Tutlihgur read *Futihgur.*

„ —32 10th line from bottom, for Fackeers read *Fuckyeers.*

„ —33 6th line from top, for Baziza read *Bezira.*

„ —33 12th line from bottom, for Bhuddish read *Bhuddist.*

„ —34 4th line from bottom, for Khan read *Khurr.*

„ —35 4th line from top, for Shimunzai read *Shimurzai.*

„ —38 6th line from top, for Malah read *Nálah.*

„ —38 19th line from top, for 100° read 110°.

„ —39 18th line from top, for Arielinum read *Arietinum.*

„ —40 4th line from top, for Bonhimia read *Banhinia.*

„ —40 5th line from top, for Tœnugric read *Fœnuqric.*

„ —40 19th line from top, for Gazma read *Garma.*

„ —40 13th line from bottom, for Semea Fut read *Semea Tut.*

„ —42 2nd line from top, for Hummums read *Hummams.*

„ —42 2nd line from bottom, for Kumer read *Kuner.*

„ —42 15th line from bottom, for Nandah read *Nankah.*

„ —44 5th line from top, for Daondzai read *Daoudzai.*

„ —45 1st line at top, for Mahaladur read *Mahaladar.*

„ —45 9th line from top, for kujah read *Kuzah.*

„ —46 10th line from top, for Piram read *Piran.*

„ —46 15th line from top, for Silk read *Skull.*

In the papers of Volcanoes and Geology of Bombay.

Page—144 Note for at supt, *read ut sup.*

„ —145 Note for Hurricane of 26th May 1618, *read* 1648.

„ —149 Note nor with any more recent account of the field of fire than about to be given, *read* than that about to be given.

Page—154 Note for Peer Muggru, *read* Peer *Muggur.*

„ —167 In the quotation at the end of the article the volume of the Bengal Asiatic Society has not been cited—it is *vol. VI.*

Page—170 Fourteen lines from the top for from opposite the Back-bay beach and Love-Grove, *read* from opposite the Back-bay beach and *the wood stacks.*

Page—178 Eleven and twelve lines from top for 1 Blue clay with Mangrove roots as before 2 Yellowish brown clay with concrete in the ordinary forms, *read* 1 *concrete,* 2 *Blue-clay with Mangrove roots as before,* 3 *Yellowish brown clay with Kunkur in the ordinary forms.*

Page—181 Ten lines from top for it appears a hard compact rock, *read* it appears *as* a hard compact rock.

Page—181 Eight lines from bottom for altogether indebted, *read* altogether *isolated.*

„ —182 Ten lines from top for the roots are cemented into, *read* the roots are *converted.*

„ —202 Section referred to at the end of para 48 will be found among the lithographs at the end where the page referred to is given.

Page—206 Ten lines from bottom for having annealed and softened, *read being* annealed and softened.

Page—212 In the sentence at the bottom of the page, the words "lying uncultivated" have been left out just after "fine promising ground."

Page—214 Last line for colouring of the drawings have been, *read has* been.

Page—291 Two lines from bottom, for shale limestone *read shell* limestone.

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PROCEEDINGS

OF THE

BOMBAY GEOGRAPHICAL SOCIETY.

At the ordinary monthly meeting of the Bombay Geographical Society, held in their Rooms, Town Hall, on the 19th September 1850,—present—The Hon'ble J. P. Willoughby, Esq., President, in the Chair; Major J. Holland; Norman Oliver, Esq.; John Ritchie, Esq.; Major P. T. French; Captain H. J. Barr; T. J. A. Scott, Esq.; Venaikrow Jugonnathjee, Esq.; Dhunjeebhoy Framjee, Esq.; John Smith, Esq.; and Dr George Buist, L. L. D., and Professor J. Patton, Honorary Joint Secretaries,—the minutes of the last meeting were read and approved of.

Dr Buist stated that being afraid he might not have it in his power to be present at the Meeting, he had taken the liberty of placing a copy of some observations he wished to have made in his colleague's (Mr Patton's) hands, in hope that he would read them. He was, however, particularly anxious to explain Dr Ford's Atmometer, and had managed for this purpose to be present; he would now, with the permission of the Society, state orally an outline of what he had written, as the time of the Society might thereby be saved.

The following letter has been received from Captain Becher, on the subject of the remittance for the Ross Testimonial.

Sir,—I am directed by Admiral Sir Francis Beaufort, to acknowledge the receipt of your letter to him of the 25th of May last, conveying the cordial thanks of the Geographical Society of Bombay to him, also to Admiral Sir Charles Malcolm and myself, for the interest taken by us in carrying out the Ross Testimonial; and assure you that we are much flattered by our very humble services being so highly appreciated.

At the same time I am to inform you, that the expence to be thus incurred will fall very far within the sum of £200, a bill of exchange for which was enclosed in your letter. I am also to request you will have the goodness to inform Sir Francis Beaufort to what Banker in London the residue of that sum shall be paid when the small expense is liquidated of purchasing the maps and preparing them and the charts as proposed.

I am at the same time to assure you, that every possible care will be taken in preparing this collection, not only with reference to the selection of the maps and charts, but also

to their ready reference and due preservation ; and that you will be duly informed when they are ready for conveyance to their destination.

I am, Sir, your most obedient servant,
A. B. BECHER, Commander, R. N.

Hydrographic Office, Admiralty, 24th July, 1850.

A letter from Commander Jenkins was produced, stating that it would be impossible for him to be present at the meeting, in consequence of a Court Martial on board the *Hastings* requesting that the motion on the notice list in reference to the Ross Testimonial should be deferred, and complaining that the substance of a part of Captain Becher's letter must have been divulged, as it had appeared in one of the daily papors, with some remarks on it by the Editor. He, Commander Jenkins, was a member of the Committee on the Ross Testimonial, and had not so much as seen the letter up to the present date.

It was explained, that Commander Jenkins on the first point was under a misapprehension—there was no motion, or notice of a motion, on the notice list, on the subject of the Ross Testimonial: on the second, that the letters, when sent for publication in circular, were equally at the disposal of all the members; so soon as the circular was issued, they were in substance published.

Dr. Buist said—we shall probably hear by next mail from Captain Becher as to the amount of balance in his hands. I have not written in reply to his letter until the Society's views on the matter be expressed: it would probably be best to place the balance in the hands of the London partners of our treasurers Messrs Remington and Co., to be drawn on, if required here, should exchange remittances from home improve. The money was remitted at par, and if necessary might be applied to the payment of the Society's accounts at home, a like amount being transferred from its ordinary funds here to that of the Ross Testimonial. There is a balance of Rs. 600 still unapplied in the hands of the Society: this, together with the other balance, will probably amount to say Rs. 1000, a sum sufficient to meet the preparation for publication of the Wind and Current Charts prepared by Mr. Macfarlane, which the subscribers to these are ready to place at our disposal as a contribution to the Ross Testimonial, provided we are willing to undertake for their publication—otherwise they are intended to be sent home.—The Secretary was directed to write to Captain Becher acknowledging his letter, and stating that he would be instructed how to dispose of the balance of the funds in his hands so soon as the amount became known. The suggestions of the Secretary were desired to lie over for consideration, as it did not appear requisite that any step should on the present occasion be taken in the matter.

The following is from Mr. Adie, our instrument maker :—

DEAR SIR,—We are favoured with yours of the 1st and 11th May, and have completed your order; we hoped to have been able to have informed you by this mail by what ship they are sent. The barometer No. 10, for which you wish another scale cut, cannot well be done without our having its present scale for size and length: if by any opportunity you could send it, we would then give another. We have not as yet heard anything of the barometer you mention as having been sent by Mr Dillon. The sympiesometer came by railway, from whence we know not, put up in a piece of pasteboard, with a charge of 10s. 2d., and as good luck would have it, all safe, and in perfect order, save want of a little regulation. We had your copy of the *Times* with a comparision of the Aneroid barometer and mercury: the agreement is certainly very close, but we should fear that you will not find it always so, and they will not do at all if taken to any considerable

altitude. In all I have tried I found them agree pretty well down to 28 inches: below this they get irregular and stop at about 27 inches. The moment I have notice of the shipment of the instruments I shall let you know.

We remain, yours faithfully,

JOHN ADIE,

ALEX. ADIE & SON.

Edinburgh, 19th July 1850.

Dr. BUIST, Secretary to the Bombay Geographical Society, Bombay.

In compliance with my intimation in May, when the account of the experiments on the Aneroid in the Annual Report of the Society was laid before you, of trying a series of experiments with the Aneroid at altitudes exceeding 1000 feet, the level at which it had been formerly tried, I took three instruments with me to Poona in the end of July. Two of these belonged to Mr Treacher, one to the Society, this last being sadly out of order: the cause of error was not observed at the time—it arose from the slackening of some of the screws, since tightened.

The results were the following—the Standard Barometers employed were Nos. 1 and 2, two of the finest sent out by Mr Adie—the way they kept together was quite admirable. The Mountain Sympiesometer referred to was a very elegant instrument procured for Colonel Campbell, whose indications were also very accurate, and in most perfect harmony with those of the other instruments.

On comparing the instruments at Sewree, about seventy feet above the level of the sea, they stood on the 22nd July at 10 A. M., as under, the thermometer being 84°, the correction for temperature of the barometer here applied ·149—the Standard at the Observatory at this date was 29·667, the instrument being thirty-two feet above the level of the sea.

Barometers.		Mountain.	Aneroids.		
		Sympiesometer.			
I.	II.		5821	5822	2244
29.676	29.662	29·750	29·765	29·790	29·780

The following were the readings of the instruments respectively at Poona at 10 A. M. on the 27th—the Observatory Standard had betwixt these two dates sunk from 29·667 to 29·587—or by 00.080:—

Temperature at Poona 76°,		Barometer corrected.			
27·713	27·713	27·830	27·800	27·802	27·650
Difference betwixt Poona and Bombay—					
1·963	1·949	1·920	1·965	1·988	2·130

The coincidences here betwixt the barometer and mountain sympiesometers, and Mr Treacher's aneroids, are as close as may be.

These experiments were performed at Colonel Grant's, at the extreme end of the Artillery lines—his house is pretty nearly on a level with the church, the top of the spire of which is set down in the Trigonometrical Survey at 2038 feet above the level of the sea. Mr Treacher's instruments were only cut to 27·5 inches and that belonging to the Society, cut to 23, was unserviceable, so that the doubt expressed by Mr Adie as to whether or not aneroids are trustworthy below to 23 inches for survey purposes, remains unsolved. I do not know if there be at the presidency

a good air pump with barometer gauge; but it seems surprising that any difficulty should be experienced in determining a matter so simple and so important as this, when a few strokes of the pump would settle it satisfactorily, without the necessity of ascending an elevation at all. Mr Dent quotes Professor Lloyd's authority on the subject of an air pump experiment—his views were most favorable to the aneroid, and altogether opposed to those of Mr Adie. Mr Glassher, of the Greenwich Observatory, again, holds very lightly of the value of the instrument. I took our own Aneroid to the top of Bapdieu Ghaut along with me—the following were the results; but, as already stated, the instrument was unserviceable, so that no conclusion from its indications can in this case be drawn—the perfection of the Mountain Sympiesometer is very remarkable :—

Bapdieu Ghaut, August 23.

	Barometer I.	Sympiesometer.	Thermometer.
Poona, 7 A. M.	27·952	28·050	76
Bapdieu Ghaut, 9 A. M.	26·747	26·850	74
	1·205	1·200	

The barometer is corrected for temperature to 32°.

The Barometer at the Colaba Observatory stood on the 23rd August at 29·845, or 1.893 higher than that at Poona: if to this be added .030 for the difference between 7 A. M., at which the upper instrument, and 10 A. M. at which the lower one, was read, we shall have a difference of 1·923, or, adding 3 for difference of elevation betwixt the Colaba and Sewree standard, almost exactly the same as that originally set down as the result of the first comparison. At Poona the range between the 26th and 31st July was about .040, that at Bombay about ·070—that for the latter part of August at Bombay about ·090 :—I have no note of the Poona range of this date, but assume it at 6, and have taken the half.

While in Poona I took with me three Aneroids with a sympiesometer into the carriage, and drove over the station to see with what facility the instruments could be employed in flying surveys. I did this repeatedly. On one occasion I was accompanied by Colonel Grant, on another by Captain Studdert; it is needless to give details—compared with the barometer the coincidences were of course always wonderful : on one occasion we took a series of levelled stations, where the accuracy was surprising. The great recommendation, both in their case and that of the sympiesometer, was the facility with which they could be observed: by pulling up the horses for a couple of minutes the scale could be read and marked at once, and one hundredth of an inch being allowed for ten feet of change of level, which it is at this elevation pretty nearly, no reductions of any sort were requisite—these could be performed at home afterwards. It is quite clear that the makers of the instrument at home have generally underrated its value for survey purposes. It is in its present form in many cases unworthy of the high state of instrument making. The scale, for example, ought always to extend round the whole dial plate so as to read as low as twenty-three inches, and to be cut out at the very extremity of the diameter of the plate,—by this means it would be enlarged by nearly a third. Each division corresponding to an inch in the barometer would thus become 18· inches in length, and each tenth of an inch might be divided into tenths, instead of quarters as at present. Troughton often cuts the scale of his marine barometers into hundredths of an inch, so as to be read without a vernier—each of the divisions recommended would be four-fifths on those referred to; still a vernier might very

easily be added if requisite. The brass register on the glass should be omitted, as likely only to endanger the glass itself; and nothing can be more absurd than to encumber the dial, and shorten the divisions of the scale, by putting round the border the words stormy, much rain, rainy, change, fair, in the case of an instrument meant for something else than an old woman's weather-glass. At Poona, at an elevation of 2000 feet, it fluctuates betwixt 27·8 and 28·5, so as to be, according to the legend, in a state of perpetual tempest even at the finest season. There are a multitude of alterations in the mechanism of the instrument which could easily be improved—those I have adverted to are so obvious that every man who procures instruments for use in India ought to insist on them.

DR. FORD'S ATMOMETER.

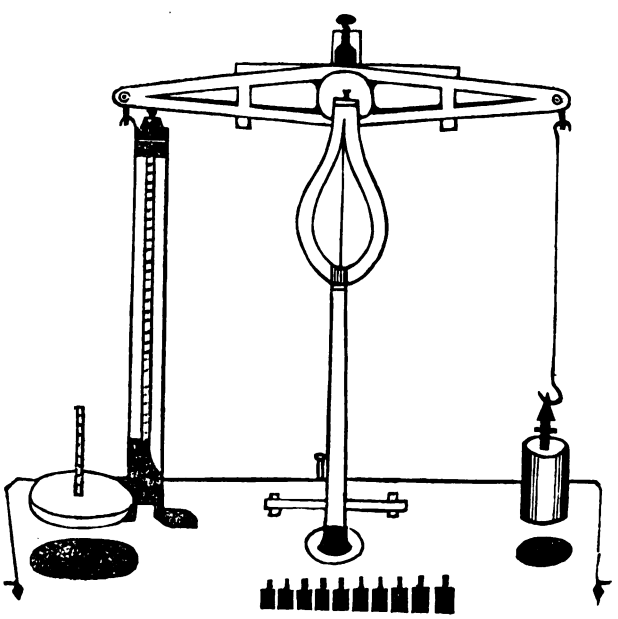
This most beautiful instrument was exhibited before the society: with the exception of the glass tube and thermometer, it had been entirely manufactured by the inventor at Hoshungabad, where no assistance of any kind could be obtained. In point of finish it was scarcely inferior to the workmanship of a London optician. The knife-edge fulcra of the balance rested in gems beautifully let in on the top of the pillars. The tongue of the balance projecting downwards, was fitted with a little sphere of brass, which screwed up and down to alter at pleasure the position of the centre of gravity, and the extremity of the tongue moved against a finely cut arch beautifully graduated. The whole as a piece of art, independent of the merit of the invention, was most perfect, and excited the admiration of all the members present.

DESCRIPTION OF AN ATMOMETER, BY DR. FORD.

This Atmometer consists of a Standard, with a double lyriform head, carrying two polished garnet tables, on which rest knife-edges of a skeleton beam. The needle of the beam points *below* to a graduated index. At the ends of the beam are two steel stirrups, riding on knife edges. To one stirrup is hooked a long hollow glass cylinder, capable of holding full three cubic inches of water. At the lower end of the cylinder is attached by a cap a large male screw, perforated for the admission of water into the tube. Within the cap-piece is a conical valve, which opens when the screw is fitted into the female screw at the side of the evaporating vase; a hole in the side of the latter, corresponds to the perforation in the male screw, and makes thus a communication between the contents of the vase and of the glass cylinder, and ensures, as from a fountain, a supply of water to the vase, proportioned to the evaporation.—At the side of the vase the bulb of a capillary thermometer just penetrates the water when the vase is filled, and indicates the temperature of the evaporating surface.—The diameter of the vase is 2·78 inches, affording an extremely small excess over six inches area. This excess may be considered annihilated by the immersion of the thermometer bulb, leaving strictly six square inches for evaporating surface. Upon the screw piece of the vase, is attached a flat plate, whereon to place the weights employed to ascertain the loss of evaporation. And to arrive sooner at the knowledge of the probable weight that will be required, the glass cylinder has been scaled to inches and one twentieth of cubic inches, and 1-40th of an inch can be readily estimated. A glance, therefore, at the loss in the cylinder will point out the number of grains, within a grain or so, needed to restore the equilibrium.—In the upper metallic cup of the cylinder there is a milled-head screw fitting air-tight, and is removable for the purpose of cleaning the cylinder at any time. The parts that will come in contact with water are made of white metal, as being less liable to corrosion from its action than brass or copper. The other

stirrup carries a stout brass wire, to which the counterpoise is hooked. This exactly balances the beam when the cylinder and vase (with Thermometer attached) are filled with *distilled* water. There is a contrivance fixed to the upper and back part of the standard actuated by a screw, by which the knife edges can be raised from the planes; and the beam has two notches on its lower surface, which are received upon two teeth on the arms of the lever, so that, when liberated, the beam can always be brought to the same part of the planes. The whole stands on a mahogany board with three levelling screws, a spirit level at the back, and weights from ½ to 550 grains in a row in front. The beam, though light sustains 12,000 grains, and will then indicate the addition of a ¼ of a grain—or the 48,000th part of the load. It is as exact as can well be, the difference between the two arms not amounting to one 20th of a grain. I regret that I had not another thermometer to spare for attachment to the standard, as the temperature of the air must be registered conjointly with that of evaporating surface.

The directions for using this instrument are very simple. The vase is filled up to the upper part of the opening in it, and the cylinder is unscrewed from the vase, and by reversing it the valve falls back, the water is then poured in, and the valve, upon inversion, comes again into play and prevents the escape of the water. It is then screwed into the vase. Should the whole now weigh more than counterbalances the given equipoise, a small quantity of the water can be removed by the corner of a handkerchief, and the true balance adjusted; or, if found wanting, a few drops can be added. To make certain that no air exists at the mouth of the valve, and intercepts the connection between the water in the cylinder and that in the vase, it is as well to tilt up the cylinder margin of the vase, and pass up the bubble of air, if one be present, or the same end may be effected by a straw or wire passed through the opening in the vase into the hollow male screw. This will liberate the bubble equally well, although with careful manipulation no air should lodge at the point of junction.



After the equilibrium has been obtained, either the entire apparatus may be raised by the gear referred to, or the cylinder or the equipoise weight, or both, may be detached from the beam. The whole should be placed under a large cage made of fine bamboo sticks, with large interspaces, otherwise birds and insects will give an erroneous value to the evaporation. This circumstance is overlooked when the ordinary evaporating dishes are employed.

I was induced to devise, and construct, the above described instrument, in the hope that by its use the solution of one of the most difficult problems of Meteorology might be facilitated, if not overcome. By it all theoretical views as to the force of vapour at various temperatures are avoided—the units here, without a risk of extraneous errors, being the *grain* weight, the cubic *inch*, the *degree* of Fahrenheit's Thermometer, and a given *interval* of time. The Barometer will of course be a most valuable adjunct. As weighing, however, is a far more accurate process than measuring, it should invariably be had recourse to in preference, and the obtained weight subsequently be reduced to cubic inches if required. Even in graduated narrow tubes it is difficult to fill up so that the measure shall at once correspond with a given weight. Let any one fill a wineglass to a certain mark, and note its weight; fill it, to all appearance, as before, and then remark the disparity when it has been weighed. Success in these attempts amounts to a sheer impossibility when a vessel of large area is employed. It is this circumstance that renders the common evaporating dish so untrustworthy. It is, likewise, most essential that the evaporating surface should be maintained at one mean height, otherwise, when it is on the gradual decrease, and falls much beneath the margin of the vessel containing the water, the evaporation is retarded. This desideratum is fulfilled in the present instrument, since the fountain will act only as required.

At present every formula (be it Dalton's, Ure's, Robinson's, Galbraith's, Joory's, or of others—and they all differ from each other) employed to ascertain the amount of evaporation, is more or less empirical and arbitrary. In this Atmometer, authorized units are only used, and so long as the accuracy of the balance remains unimpaired, and any degree of attention be paid to the registrations, the results must approach in character and degree those of a natural process.

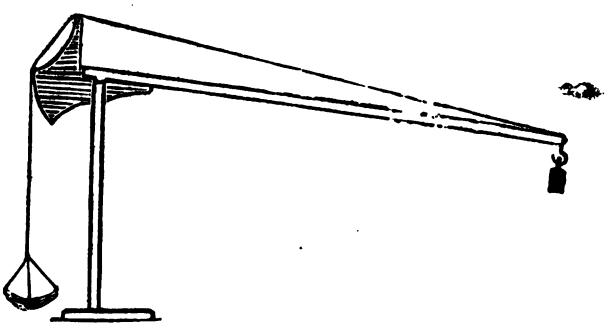
As no strictly true value can be allowed to the ever varying power and dryness of the wind, it will be more advisable to place the instrument in a shaded open space, cut off equally from irregular currents of air and refracted heat.

C. G. E. Ford.

Hoshungabad, July 16th, 1850.

Two years ago I had the pleasure of directing the attention of the Society to the extreme difficulty of carrying out hygrometrical experiments,—pointing out the extraordinary degree of neglect and inattention with which the subject of evaporation had been treated. The common wet and dry bulb, the hygrometer of Daniell, and others, merely indicate the quantity of moisture in the air—evaporation is not only dependent on this, but on the velocity of the wind, I then laid before you a model of an atmometer on the steel-yard principle, consisting of a balance, with unequal arms,—the shorter of these having an arched segment at the extremity. From this an evaporating dish, like that of Dr. Ford, was suspended; this, when filled with water, was so adjusted and counterpoised as to be in equilibrio with the steel-yard when this stood in a horizontal position, and of course as the water was drawn off by evaporation, the long arm descended, the amount of descent

indicating the evaporation, being marked on an arched index. The whole, with the exception of the evaporating dish itself, which was left freely exposed, was enclosed in a glass-case to free it from the action of the wind. Having in reply to Dr. Ford's letter accompanying the instrument now before you, explained these circumstances to him, the following are some extracts from his answer—I do not altogether concur in his objections to my plan, but they are well worthy of being laid before the meeting :—



"You must bear in mind that the working parts of the instrument are simple enough, and could be readily made at a small cost, and yet ensure great accuracy, for many of the parts in my construction, and which give the whole a complex appearance, are not absolutely needed : for instance, the gear to raise the beam—the spirit level and levelling screws—these could be without great loss to the action of the instrument, withdrawn. I would engage to make accurately working instruments of the kind absolutely required for rigid and continued investigations, for twelve or fifteen rupees each. The instrument I sent you was more as a model than anything else, and I considered, at the same time, that if ever required, it would, by the addition of a pair of pans, be convertible into a Hydrostatic balance, for it is very accurate and sensitive. Besides, I look upon evaporation as a most delicate investigation, and one only to be mastered by the best of instruments. The great point in any construction of the evaporating dish, is to provide a constant flow proportioned to the rate of evaporation, otherwise the thermometric readings of the evaporating surface cannot be arrived at, and neither can that surface be placed under precisely similar circumstances throughout any two hours. Had it not been that I saw the imperative necessity of meeting both these desiderata, I should merely have appended an evaporating dish to a spring

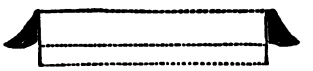
balance of a somewhat delicate construction—but even then, no spring balance can be made which would carry 1000 grains, and indicate an alteration of one grain. And this objection applies to the lever balance (as your's is), for no arch could be graduated to grains without great expense, and the arm too must be so long that its weight would interfere sadly with the working of the edges. It has ever been found that the only description of balance by which exact measure can be attained is the one with arms as equal as can be approached by art, and when made with the ends of arms in loops, likewise the cheapest, for then the points of bearing can quietly be brought to or withdrawn from the centre. I only contend for the advantages of the fountain as an original part of my construction, and one that would not increase the price of my instrument five or six shillings if made in England. The means of obtaining the results might bevaried as the observer pleased. All may not be such great sticklers for accuracy that I conceive myself to be, and some would employ one kind of balance, and some another, whilst others, again, would be satisfied by a scale of parts of a cubic inch. You may depend upon it that unless the instruments now in use in meteorological investigations be very much improved, and a rigid tone and character be given to all observations, the science will remain in statu quo. If such a tone and character could be instilled through the instrumentality of the Geographical Society, the greatest boon to meteorology would be conferred, for then we should find thermometers made, or with the names of Lord, Brownhead and other barbers, exploded from the scene of enquiry. I have seen instruments with such names, the tubes of which were only fit to stir up acids! This should be one of the earliest endeavours, in my opinion, of the Society. It will strike at the root of all worthless toys, and the consequent observations of the same nature."

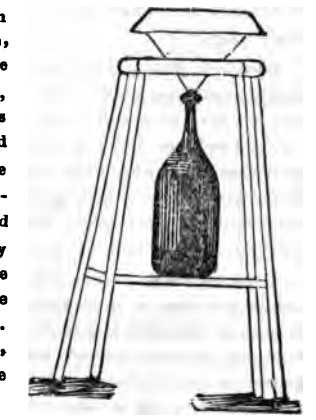
It has been all along the aim of the Society to do in reference to meteorological instruments exactly that which is here recommended. We wish to make use of none but the best, and desire to sanction no sort of instrumental observations which is not pursued with a rigidness and care worthy of the subject. The very great trouble attendant on hygrometrical observations when actual weighing was resorted to in absence of an instrument such as that now before you, made me fall back on the following plan as much more simple and desirable than any now in use, and as greatly less laborious, if less accurate than actual weighing—I take it from our Handbook now being printed :—

" The first condition of an evaporating dish is, that the form of its surface shall be such that its area may be determined with perfect accuracy—a state of things, as already mentioned, with which a circle alone is compatible ; the second, that its side shall be parallel to its axis, and its area perfectly uniform to the depth that evaporation may chance to extend betwixt any two observations—that is, for an inch or so at least. The third condition is, that we shall be able to observe the precise amount of water evaporated within a given time—say twelve or twenty-four hours. Rain-gauges such as have been elsewhere described, fulfilling all these conditions, may be used as evaporating dishes—the ordinary evaporating dish, the contents of which are poured out into a glass measure, I consider all but useless. When a cylinder, or funnel with a cylindrical mouth, is used—the limit to which the water ascends may be determined, as follows:—place a light bar of wood or metal across its mouth—through this thrust two pins, the one protruding say 1-100th of an inch or so—the smaller the quantity the better—further than the other. Fill up the dish with water till the pin most prominent just dips into it—the less prominent

pin not quite touching the surface. The two ought to be as far apart as to preclude the second from being affected by the little mass of water raised by the capillarity of the first above the general level. The arrangemnet may be very conveniently reversed by placing a stick athwart the dish, and pointing the pins upwards—or a combination of the two may be resorted to. An evaporating dish of this sort is carefully filled at starting: the next day as much water is poured into it as brings it up to the original position, from a measure, previously accurately divided into so many grains and so many inches and decimals, for both ought to be indicated on the measure,—the latter only to be read:—the water required for this will indicate the amount carried off in vapour. These observations can only be made when the air is perfectly still, and as the evaporating dish ought to be exposed to the breeze, so a moveable screen must be provided to secure shelter while observing, and permit the breeze to exercise its full force when the dish is in use.

"I have found the following contrivance very convenient indeed for the purpose of determining evaporation. Procure a dish edged and turned the same as the rain-gauge funnel already described (page 28.) In this case the mouth of the funnel must be provided with a stop-cock—or where this is not procurable, with a plug or cork. The funnel ought to be made to hold a quart exactly, quite up to the brim, and this it will do if made two inches deep,—the conical portion one, and the cylindrical portion one; and six and a half inches wide—the extra half inch being allowed for the insertion of the turned rim, which will bring it down to six inches. The funnel being put in its place, a quart bottle, carefully filled with water exactly to the neck, is now emptied into it, and the bottle itself placed under it, on a stand like that represented in the accompanying diagram. On first filling the evaporating dish, the bottle full should be poured in and emptied out several times to see how much exactly is kept back on the sides of the funnel after some minutes have been allowed for it to drip—the plug being thoroughly soaked at the same time. All these precautions having been duly attended to, the dish is filled—the deficiency next day in the bottle will indicate the amount of evaporation.





"The marks of the measuring tubes are made to read both ways by figures both above and below the lines. The best way is to fill the tube up to the top of the scale exactly: then open the stop-cock and let the water flow into the measure, taking great care that none is allowed to run over or spill. Note the number of grains run out, and divide this by the number of grains corresponding to the area of the evaporating dish as found in the table, adding ciphers—the quotient will give the amount of evaporation.

"*Example.*—The area of the evaporating dish is 6 inches:—a stratum of water of this area one inch in thickness weighs 7158·5974152 grains—the decimal may be dismissed. Sup-

posing that it loses 941 grains, as indicated by the scale on the tube, to supply the amount of one day's evaporation: then

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7158)941·0000(0·1314
     715 8
     -----
     225 20
     214 74
     ------
      10 460
       7 158
      -------
       3 3020
       2 8632
      -------
        4388
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So that the evaporation amounts to no inches —·1314 merely: it is seldom necessary to go beyond the place of thousandths of an inch.

"The graduations marked on a bottle which suffice for rain-gauge purposes, are scarcely delicate enough for those of evaporation—for the former evaporating dish first described, they are unserviceable altogether. The following is the method of graduation and measure I have resorted to to secure a standard. For an unit of measure I have found the bulb, if spindle-shaped, and part of the stem of a broken thermometer, well suited. It must first be carefully emptied and dried—then weighed—then filled with water up to the neck of the stem and weighed again—as much more should now be added as gives one or two grains more, according as the length of the stem allows: from these fill up the bulb to where the bore becomes uniform. In a fine bored thermometer a grain will occupy an inch in the stem, and may be subdivided by measurement into tenths or twentieths—the bulb will hold from ten to fifteen or twenty grains. All these operations are performed before an aperture is secured in the lower part of the bulb—and marks should be made for say ten, fifteen, or twenty grains of water at different temperatures from 80° to 90°—those we have most commonly to deal with in India. If these experiments have been accurately performed, the unit measure may now be carefully heated—the point of it being approached to a lamp, and drawn out, so as to secure a capillary aperture below. If this be well managed, the error occasioned by the bore now opened will rarely amount to the tenth of a grain. This measure does not often require to be resorted to. The most convenient for an unit of larger size is what is called a quill tube,—that is, a tube of glass, about the thickness of a crow-quill, as thin in the walls as can be made: a piece a foot long at least should be taken, and one end of it sealed up. It should now be gauged in the manner formerly described—if not uniform in diameter it is useless for the present purpose. The tube is now suspended from a fine beam, and counterpoised; fifty grains are next added and marked, and a second fifty may be poured in to make sure—this being marked also by a slight scratch on the tube. The spaces between the marks are now taken off by a pair of compasses, and a paper scale the length of the tube laid down on a drawing board, and very carefully ruled and divided. This is then gummed or pasted on, the fifty grain marks

on the scale and tube being placed together : the point of the tube may now be heated by a lamp, and drawn out so as to secure a capillary aperture as before. The fundamental measure once made, should be placed in a box for reference, as it is very apt otherwise to get broken, and much dexterity, time, and care, are required for its construction. Tubes of greater bore for similar purposes are graduated from this—after being gauged and prepared as before.

"Those required for measuring purposes are fitted up with a stop-cock—grains are marked in black on one side of the scale, decimals of an inch on the other,—the tube being filled by sucking the water up into it, and any excess that may exist being allowed to drop through the stop-cock, until the graduated portion of the scale be attained. The figures ought to read from the upper end downwards, so that the tube may always be filled full, and as much water drawn off as is required to fill up the gauge to the pin points, or the bottle to the mouth. The expansion of water betwixt 70° and 90°, our usual temperatures, is so insignificant, that no account of it need be taken."

The following books, papers, &c., presented to the Society since last meeting, were laid on the table, and the donors desired to be thanked for the same :—

PAPERS.

Meteorological Abstracts for the Month of July last, taken at Aden, Calcutta, Trevandrum, Coconada, and Cuddalore.

Ditto ditto for the month of August last, taken at Sattara.

From Government.—Weather Reports furnished by the several Political Authorities in Guzerat since the setting in of the Monsoon.

BOOKS.

From Government.—Journal of the Indian Archipelago, for April last. From the Hakluyt Society.

Presented by Government.—Journal of the Indian Archipelago, and Eastern Asia, for the Months of May and June.

MAPS.

From Government.—Map, Plan, and Sketches alluded to in the paper of Commander F. Jones, I. N., presented by Government on the 12th July last.

LETTERS.

From J. G. Lumsden, Esq, Secretary to Government Political Department, No. 3903, dated the 20th August last, forwarding, with a view to assist the Meteorological inquiries now in progress under the guidance of the Society, copies of the weather reports furnished to Government, by the several Political Authorities in Guzerat, since the setting in of the monsoon.

From the Secretary to the Medical Board, dated 21st August last, requesting to be informed if the Society could supply him with three sets of the forms for Meteorological observations lately circulated by Government throughout the Presidency.

From J. G. Lumsden, Esq., Secretary to Government General Department, No. 3400, dated 26th August last, transmitting, for presentation to the Society, a copy of the Journal of the Indian Archipelago and Eastern Asia, for the month of April.

From Major G. LeG. Jacob, dated Sawunt Warree, 19th August last, stating that his attention has been drawn to an error of the press in the note to page 21, article 1, of the Society's Transactions, in the volume for the period between May 1844 and February 1846, by the mistake having been copied into Briggs's Cities of Gujarashtra, Chapter IX, page 198, and requesting that the same might be rectified.

From R. C. Knight, Esq., dated Kotah, 23rd August last, acknowledging the receipt of Dr. Buist's letter, No. 55, dated 15th July last, and requesting that the instruments mentioned in his letter might, with the exception of the Sympiesometer, be ordered for and transmitted to him through Mr. Hewett's Agency.

From Mr. Mayes, dated Seerah Island, 27th August last, forwarding his observations for Shum Shum for the month of July last, and the Anemometer papers for Seerah and Shum Shum; intimating at the same time that he has reduced the direction in the Azimuth and the pressure into pounds and decimals of a pound.

From J. S. Law, Esq., dated Tanna, 7th instant, enclosing a cheque for Rs. 15, on account of his annual subscription to the Society for the year 1850-51.

From W. E. Frere, Esq., dated Dharwar, 4th instant, intimating that he has remitted, through the Civil Pay office, the sum of Rs. 15, on account of his annual subscription for the year 1850-51.

From Captain E. Whichelo, Deputy Commissary General, No 4894, dated 20th August last, intimating that the Marine Barometers forwarded to him for inspection, with the Society's letter No. 70, had been approved of and accepted by the Medical Storekeeper, and requesting to be furnished with the hooks appertaining thereto.

From J. G. Lumsden, Esq., Secretary to Government in the Marine Department, No. 878, dated 2nd Sept., acknowledging the receipt of the Society's letter No. 64, dated 29th July last, and stating that the Society can use its discretion with regard to the arrangements proposed in the three first paragraphs thereof, and also intimating that the Society's recommendation in favour of Mr. Leech will be referred for the sanction of the Government of India.

From J. G. Lumsden, Esq., Secretary to Government in the General Department, No. 3635, dated 16th September, transmitting for presentation to the Society, a copy of the Journal of the Indian Archipelago, and Eastern Asia, for the months of May and June last.

From R. K. Pringle, Esquire, dated Kurrachee, 12th September, inclosing a cheque on the Bank of Bombay in payment of his subscription, Rs. 15, to the Society for the year 1850-51.

From Dr. Alexander Gibson, dated 12th September, requesting to be furnished with a copy of the number of the Society's Transactions just published, on payment.

From Lieutenant A. Aytoun at Malligaum, an extract from the list of Remittance from Pay Abstract for the month of August 1850, for Rupees (7) seven, on account of the Admiralty Manual forwarded to him.

Commander J. Stephens, I. N., was elected a Member of the Society. He was proposed by Commander Jenkins, I. N., seconded by J. Smith, Esq.—Dr. Shaw, Secretary Royal Geographical Society of London, will at next meeting be proposed as an honorary member of the Society.

It was moved by Major Holland, seconded by Dr. Buist, and agreed to unanimously, that the Regulations of the Society, as now revised, should be printed for their future guidance.

It was moved by Major Holland, seconded by Mr. Patton, and agreed to unanimously, that Dr. Ford should be written to, thanking him for his goodness in sending his Atmometer for their inspection; and requesting that he would allow the Society to purchase it from him, with the view of its being retained in their rooms for exhibition and for use.

The meeting then broke up.

THE ordinary monthly meeting of the Bombay Geographical Society took place on the 24th October 1850, at 3 o'clock—The Honorable J. P. Willoughby, Esq., President, in the Chair. Present: Colonel Campbell; Commander G. Jenkins; Captain French; Lieut. Taylor, I. N.; Lieut. Pollexfen; Ali Mahomed Khan; Venayekrao Jagonathjee, Esq., and Dr. G. Buist, Secretary.—The minutes of last meeting were read and approved of.—The paper on the Aneroid, by Mr. Patton, was not presented, that gentleman being absent from the Presidency.—A letter from Mr. Lumsden, under the Marine department, in reference to the Instruments borrowed by the Society from Government, was laid on the table, with a draft of a reply. The Secretary was directed to state in reference to the instruments received from Government on loan, that the Society were ready to restore them when wanted, provided they were not considered by Government to be already fulfilling the objects in view for them: they were in use at Sawunt Warree, Aden, Porebunder, and Kurrachee,—stations Government had agreed to provide with instruments. In reference to the instruments in the possession of the Society, it was directed to be explained that these were on sale merely, and had been provided for the service of those desirous of purchasing and employing them. That the Society had at no time contemplated their use on its own account, or incurring further risk regarding them than what might arise from those which might be broken, or left on their hands unsold. No allowance for either of these contingencies had been made—the instruments were charged exactly at the prices paid for them, including freight: there had luckily been no breakages on the way.—The following Motions were unanimously agreed to :—

MOTIONS.—That the following be added to the Regulations :—

" That the Society shall present copies of its *Transactions* to the principal Public Libraries in India, Europe, and America, and exchange them with Societies and with such Authors or Publishers as are disposed to bestow works of equivalent value, or nearly so, on the Library of the Society."

The Committee on Physical Research has hitherto consisted of the Deputy Superintendent of the Indian Navy, the Deputy Quarter-Master-General, and the Officer in charge of the Observatory. The two parties last named are not at present members of the Society,—and it is proposed—

" That the Committee shall hereafter consist of Captain J. Hawkins, Deputy Superintendent of the Indian Navy; Major J. Holland, Quarter-Master-General; Captain H. J. Barr, Paymaster-General; Lieutenant Taylor, I. N.; John Ritchie, Esq.; and the Secretaries."

Dr. Shaw, Secretary to the Royal Geographical Society of London, was admitted an honorary member, and Captain J. Willoughby an ordinary member.—It was proposed by the Hon'ble Mr. Willoughby, seconded by Commander Jenkins, and agreed to unanimously—"That His Excellency Rear Admiral De Tromelin be admitted an honorary member of the Society." As the Admiral was stated to be on the eve of his departure, the usual notice required to be given was dispensed with.—Colonel Campbell proposed that Lieutenant Wray should be balloted for as a member at next ordinary meeting.—No other business appearing before the Society, the meeting broke up.

LETTERS.

From Captain S. B. Haines, dated Aden 13th September last, forwarding an order on Messrs. Remington & Co., on account of his annual subscription for 1850.

From Captain R. Ethersey, dated Kurrachee 21st September last, enclosing an order on the Bombay Bank for Rs. 62, being the amount due by him to the Society on account of Instruments.

From J. G. Lumsden, Esq., Secretary to Government in the Marine Department, No. 979, dated 21st September last, requesting the Society to communicate with the Military Board on the subject of the concluding para of the Society's letter No. 50, dated 19th June, 1850.

From Henry J. Carter, Esq., Secretary to the Bombay Branch of the Royal Asiatic Society, No. 161, dated 30th September last, informing that the best thanks of the members were voted to the Geographical Society for the present of a copy of its transactions.

From A. Matheson, Esq., Acting Collector of Vizagapatam, dated 7th ultimo, recommending Mr. Juggarow as an accurate observer, who has an observatory of his own, and takes much interest in Meteorological Researches, and informing that he has kindly undertaken to furnish returns of the description required by the Society.

From G. V. Juggarow, Esq., dated Vizagapatam 21st September last, requesting to be supplied with a certain number of instruments to keep a regular Meteorological Register, and enclosing an Accountant General's Bill for Rupees (400) four hundred, in favour of Messrs. Line & Co.

From Messrs Smith, Elder & Co., dated London 19th August last, enclosing an account, for dispatches to the Society during the past half year, amounting to £8. 9s. 6d.

From Walter Elliot, Esq., Revenue Commissioner, dated Vizagapatam 12th ultimo, strongly recommending Mr. Juggarow as an accurate observer, and a great lover of Meteorological investigations.

From Captain E. Whichelo, Deputy Commissary General, No. 5790, dated 2nd October, requesting to be informed if the Society would be able to supply certain Instruments enumerated by him.

From Captain W. Strange, Nizam's Cavalry, dated Gulburgee 9th instant, acknowledging the receipt of the Secretary's letter of the 29th July last, enclosing a hoondee for the sum of Rs. 44, and requesting that the Aneroid Barometer, selected for him, should have a thermometer attached to it.

From J. G. Lumsden, Esquire, Secretary to Government, General Department, No. 3933, dated 5th October last, requesting the Society's acceptance of a copy of Brigg's Cities of Guzerastra.

From C. Hathway, Esquire, Civil Surgeon at Lahore, No 118 dated 27th September 1850, stating in reply to the applications for Meteorological observations to be kept at Lahore, made by the President of the Board of Administration at the request of Dr. Buist, that he shall be most happy to register the readings of any Instruments that the Geographical Society can place at his disposal for the purpose therein required.

From A. Freere, Esquire, Collector of Chingleput, dated Pulle Carny 19th September last, suggesting that if the Meteorological Observations be entrusted to men of Education, whose occupations enabled them to remain at one station, the returns will be much more correct and useful, and the object the Society has in view will be more readily attained, and informing that the Civil Surgeons at Poonamalee, and Chingleput have expressed their willingness to undertake the observations in question, if supplied with the requisite Instruments.

From Captain C. Birdwood, Assistant Commissary General, dated 7th instant, No. 5878, requesting to be informed whether the Society can supply him with an Anemometer.

From Commander Charles. W. Montriou, I. N., Superintendent of the Colaba Observatory, dated 14th instant, No. 56 of 1850, forwarding, by direction of the Right Honorable the Governor in Council for presentation to the Society, one copy of Part 1st of the Observations made at the Colaba Observatory during the year 1847, containing the Meteorological Observations.

From G. V. Juggarow, Esquire, dated 7th instant, forwarding a memorandum of the Rain measured at Vizagapatam, and stating that part of which from 1830 to 1838 was kept by his uncle, and the rest by himself, also informing that he has commenced from the 1st instant to keep a regular registry of the Meteorological Observations, according to the printed form circulated by the Madras Government and recommended by the Medical Board, and stating that he shall be most happy to attend to any suggestions that may be hereafter offered.

From Mr Mayes, dated Aden 27th September last, offering his services to reduce the Observations now in hand, and promising to reduce them before they have been dispatched from Aden in future.

From Dr C. G. E. Ford, acknowledging the receipt of the Secretary's letter of the 3rd instant, and stating that it was his intention, when forwarded, to have the Anemometer presented to the Society, and now begging to express that the Instrument is quite at the service of the Society.

PAPERS.

Meteorological Abstract taken for the month of August, at Trevandrum.

Ditto Ditto Ditto Ditto Ditto. of August, at Cuddalore and Coconada.

Ditto Ditto Ditto Ditto Ditto. of September, at Aden.

Ditto Ditto Ditto Ditto Ditto. of July, August, and September, taken at Kolapoor.

Ditto Ditto Ditto Ditto Ditto. of September, at Ahmedabad.

Ditto Ditto. taken for the month of April, May, and June, at Bushire; accompanied by remarks by Dr. McAlister Residency Surgeon at the Persian Gulf.

Ditto Ditto. state of the Thermometers in the shade taken at Neemuch for the month of September last, accompanied by remarks from Dr J. P. Malcolmson, Surgeon 3rd Regiment Light Cavalry.

BOOKS.

"Brigg's Cities of Guzurastra." Presented by Government with a letter No. 3933 dated 5th October 1850.

Journal of the Bombay Branch of the Royal Asiatic Society, Part XIII. vol. III. January 1850. Presented by the Society.

Journal of the Indian Archipelago and Eastern Asia for the month of July and August last, Presented by Government.

Bombay Magnetical Observations, Part I. for 1847. With a letter from Commander C. W. Montriou. I. N. Superintendent of the Colaba Observatory.

INSTRUMENT.

Atmometer, presented by Dr C. G. E. Ford, at Hushingabad, with a letter dated 12th October, 1850.

THE ordinary monthly meeting of the Bombay Geographical Society was held in its rooms, on Thursday the 21st November 1850. Present.—The Hon'ble J. P. Willoughby, Esq., President, in the chair; Henry Young, Esq.; Captain H. J. Barr; Norman Oliver, Esq.; Commander G. Jenkins, I. N.; B. A. Bremner, Esq.; Lieutenant-Colonel J. Holland; Venaikrow Jugonathjee, Esq.; Dhunjeebhoy Framjee, Esq.; Manockjee Cursetjee, Esq.; S. S. Dickinson, Esq.; Lieutenant J. J. Pollexfen; Commander G. B. Kempthorn, I. N.; and Professor J. Patton, Joint Secretary.

The minutes of the last meeting having been read and approved of, a letter was laid before the Society from Mr Goldsmid, Secretary to Government, forwarding an interesting account of the Storm that occurred in Kattiawar in July last. The paper was referred to the Committee on papers for publication.—The Secretary brought forward the recommendation of the Committee on Physical Research in reference to the employment of Mr Mayes. The Committee having decided that the observations already taken at Aden were quite sufficient for all scientific purposes, it was determined a year since to withdraw Mr Mayes from Aden, and employ him in establishing Observatories at Suez, the Persian Gulf, and Zanzibar. No answer has as yet been received from the government of Egypt, whose permission was necessary previous to establishing the observatory at Suez, and the Committee therefore recommend that Mr Mayes should be detained for the present at the presidency, for the purpose of arranging, reducing, and passing through the press, the whole of the Aden observations, and that should he have any time, he might be employed in superintending local observations. The draft of a letter to Government on the subject was then approved of.—Professor Patton read the following paper on the Aneroid Barometer, which the Society directed to be printed for immediate circulation, and also to be published in the next volume of the Society's Transactions :—

REMARKS ON THE ANEROID.

Considerable discussion has of late arisen on the subject of the Aneroid Barometer, and great uncertainty still exists in reference to its utility. A letter from the eminent instrument-maker, Mr Adie, read before a late meeting of this Society, has tended very much to increase previously existing doubts of its usefulness in ascertaining high altitudes, for which its portability and cheapness would have made it particularly suitable. This Society also having ordered a supply from England, it is of great importance not only to have those doubts set at rest, but also to have some means of testing their correctness in order to inform purchasers of the limits within which they can be trusted. In order to do so, I obtained two Aneroids, one belonging to Mr Treacher, graduated to 27·5 inches, and one belonging to the Society, graduated to 23 inches, and subjected them to the following experiment. In the neck of a flask containing a small quantity of mercury, I inserted a small bent tube, and when the flask was inverted, the mercury of course stood at the same level in the flask and in the tube.

The flask was properly supported on a small retort stand, and the Aneroids were then placed under the receiver of an air-pump, and a few strokes given to the pump. When the air became a little rarified in the receiver, the elastic force of the air in the flask pressed down the mercury, and the degree of exhaustion was measured by the altitude to which the mercury rose in the tube. Therefore, neglecting for the present the diminution of the elastic force of the air in the flask, arising from the increase of volume, and neglecting also the temperature under the receiver, the *rise* of mercury in the tube should be exactly

equal to the *fall* indicated by the Aneroid, and vice versa. And this was the case in each of the experiments, as will be seen from the readings given below. The air was first pumped out, and the receiver, not being perfectly air-tight, it re-entered gradually, and readings were taken at the same instant by himself and Mr Ardaseer Framjee.

Treacher's Aneroid.—No. 1.

Aneroid.	Height of Mercury in tube.
Inches.	Inches.
27.5	2·55
28·0	2·25
28·5	1·55
29·0	1·05
29·5	0·55
30·05	0.00

Aneroid.—No. 2.

1st Experiment.		2nd Experiment.	
Aneroid.	Height of Mercury in tube.	Aneroid.	Height of Mercury in tube.
Inches.	Inches.	Inches.	Inches.
26·0	3·9	24·5	4·75
26·5	3·35	25 0	4·25
27·0	2·8	25·5	3·7
27·5	2·35	26·0	3·2
28·0	1·85	26·5	2·7
28·5	1·35	27·0	2·2
29·0	0 85	27·5	1·7
29·25	0·6	28·0	1·2
		28·25	0·975
		28·5	0·7
		28·75	0·425
		29·0	0·2
		29·7	—0·5

In the first experiment, the Aneroid rose 2·55 inches, and the mercury fell the same; in the second, the rise is 3·25 inches, and the fall 3·3; and in the third, the rise is 5·2 inches, and the fall 5·25 inches.

This close coincidence is remarkable, and requires to be accounted for, and explained, because it would really indicate a considerable error in the Aneroid rather than prove its exactness. In the last experiment the mercury in the tube fell 5·25 inches: the volume of the air in the flask was therefore lessened, and consequently its elastic force increased. This increase I ascertained by measuring the volume of the air in the flask, and the volume of 5·25 inches of the tube to be equal to a pressure of ·27 of an inch of mercury. The Aneroid, therefore, instead of coinciding, should have differed by this amount from the reading of the tube: that is, the mercury should have fallen less then the Aneroid by ·27 of an inch. But a little consideration of the circumstances of the case will account for the discrepancy, and prove that in this large range of 5·25 inches, the Aneroid differed by a less quantity than ·27 of an inch from the truth. The total fall of mercury in the tube should be diminished by the rise of the mercury in the flask, and this must have amounted to about one-tenth of an inch. The mercury used in the experiment was not pure, and should be corrected for temperature; and therefore the fall, which seems to represent a change of pressure of 5·25 inches, must be much less, and when the increased pressure in the flask is then added, the discrepancy will be inconsiderable. I have not been able to ascertain the amount of error due to these causes, nor to the change of temperature of the air in the receiver, but in future observations with more perfect apparatus I shall be able to do

so. From these experiments I felt satisfied that the Aneroid No. 2 would not differ from a mercurial barometer by more than one-tenth of an inch, if carried to a height of six thousand feet. Since these experiments were made, I have had an opportunity of taking it with me to Mahabuleshwur, and of comparing it with the Sympiesometer, and the results given below show how accurately my anticipations have been fulfilled,—at least as far as 4500 feet. Dr Buist's observations at Poona had already proved its correctness to the heigh of 2000 feet.

	Aneroid.	Sympr.	Ther.	
October	19.—29·8	29·56	90·0	12 o'clock noon—level of sea.
,,	19.—27·725	29·5	83·5	3 Do. do. do.
,,	20.—29·85	29·65	83·6	9½ A. M. Mhar River.
,,	20.—29·155	28·93	85·5	5½ P. M.
,,	20.—25·79	25·54	68·5	9½ P. M. Monastery, Mahabuleshwur.

The coincidence between the two instruments is seen to be very exact, the total fall of the Aneroid being 4·01, and of the Sympiesometer 4·02.

The following are the readings of the Aneroid and Thermometer at different places between Mahabuleshwur and Poona :—

	Aneroid.	Ther.	
October	21.—25·756	65.0	9½ A. M. Monastery, Mahabuleshwar.
,,	21.—25·9	68·0	4 P. M. Top of Tai Ghaut.
,,	21.—27·175	72·0	5 P. M. Bottom of do.
,,	22.—27·75	73·5	Top of Ghaut.
,,	22.—27·88	75·5	Bottom of do.
,,	22.—26·725	81·0	Top of Ghaut near Poona, 6 P. M.
,,	22.—27·87	80·0	Poona lines. 10 P. M.
,,	23.—27·77	81·5	Do. do. 9½ P. M.
,,	23.—27·87	78·5	Do. do. 10 A. M.

A very slight examination of these observations will show how sensibly the Aneroid is acted on by the smallest undulations of the ground, and that it acts as freely at 25 inches as at 30.

They make no pretence to great accuracy, because most of them were taken when the palkee in which I was carried was in actual motion, but this only proves more strongly the value of the instrument for general purposes.

When the merits of the Aneroid become known, and confidence is placed in its indications it will probably supersede all other portable instruments for ascertaining the heights of mountains : I have therefore prepared the following table, which will enable any one who can multiply and divide to obtain altitudes with all the accuracy that is required for practical purposes. The formula used in the calculation is given by Poisson in the second volume of his *Traite de Mechanique* :—

$$Z = 18393 \ldots \left(1 + \frac{2\,(t+tl)}{1000}\right) \text{Log.} \frac{h}{hl}$$

Where t and t are the temperatures of the air in degrees of the centigrade thermometer at the two places of observation, h and h the length of the barometric columns, and Z the height in Metres.

Table to facilitate calculations of heights of mountains.

32°	52416	47°	54163	62°	55911	77°	57658
33	52532	48	54280	63	56027	78	57774
34	52649	49	54396	64	56143	79	57890
35	52765	50	54512	65	56260	80	58007
36	52882	51	54629	66	56376	81	58124
37	52998	52	54745	67	56493	82	58240
38	53115	53	54862	68	56609	83	58356
39	53231	54	54979	69	56726	84	58472
40	53348	55	55095	70	56842	85	58589
41	53464	56	55211	71	56959	86	58706
42	53581	57	55328	72	57075	87	58823
43	53697	58	55444	73	57192	88	58939
44	53814	59	55561	74	57308	89	59055
45	53930	60	55677	75	57424	90	59172
46	54046	61	55794	76	57541	91	59288

RULE.—Multiply the number in the table opposite to the mean of the temperatures of the two places in degrees of Fahrenheit, by the difference of the barometric heights, and divide by their sum. The quotient is the height in feet.

EXAMPLE.—On the 20th October 1850, the barometer stood at 29·85 in the Mhar river near the sea, the thermometer indicating 83·5; and at the Monastery Mahableshwur it fell to 25·79, and the thermometer to 68·5. Required the height. Here the mean temperature is 76°, opposite to which in the table is found 57541, which being multiplied by 4·06, the difference, and divided by 55·64, the sum of the barometric heights, gives 4198 feet, the height required.

Table of Heights found by the Aneroid.

Kenesore above the level of the sea	feet	665
Monastery Mahabuleshwar	feet	4198
Mount Charlotte above Monastery	feet	324
Mount Charlotte above the level of the sea	feet	4524
Tal Ghaut	feet	1362
Height of Ghaut above Poona	feet	1216
Poona above the level of the sea	feet	2025

These heights, as far as I have been able to ascertain, coincide very nearly with the heights ascertained by other means. Indeed no single observation of the barometer at one of the places could be expected to give it more accurately.

Leslie's rule is very convenient, and sufficiently accurate; but the correction for the temperature of the air at the two places is often neglected in practice,—and even in some scientific works the fact of a correction being required is not mentioned. But this correction cannot be omitted, because in the case of Mahableshwur it amounts to upwards of 400 feet, and in the case of Poona to about 180 feet. The results, however, are alway too small, because in his investigation, he was only anxious to obtain an approximation, and neglected systematically all but round numbers, and all the omissions tended to reduce the apparent height. Near the equator the diminution of the force of gravity is another source of error, which still more diminishes the height deduced from the usual formula. I have therefore used, in the formation of the table given above, the number 52416, deduced from Poisson's formula, in preference to 52000 used by Leslie. Besides, the thermometers in general use being graduated according to Fahrenheit's

scale, it is inconvenient to be obliged to convertthe degrees into those of the centigrade. As some persons may prefer the use of his rule, I add it, with the example given above worked out.

LESLIE'S RULE.—As the sum of the mercurial columns is to their difference, so is the constant number 52000 feet to the approximate height. Correct the approximate elevation by shifting the decimal point three places back to the left, and multiply by twice the sum of the degrees of the detached centigrade thermometer; this product being now added, will give the true height.

Taking the former example, we have—55·64 : 4·06 : 52000 : 3793, the approximate height and the correction is 3·798 ft. × 99·7=378, which gives for the true height, 4171, differing from the former by 27 feet.

Of the more minute daily variations, and the corrections, if any, that are to be applied, I hope to be able to have some account for the next meeting of the Society.

21st November, 1850. JOSEPH PATTON.

The thanks of the Society were given to Mr. Patton for his communication.

The following Letters, Papers, Books, &c., received since last meeting, were laid before the Society :—

LETTERS—From C. Morehead, Esq., Superintendent of the Grant Medical College, No. 47, dated 24th October last, transmitting for the use of the Society's Library, a Copy of the Report of the College for the Session 1849-50.

From His Excellency Admiral De Tromelin, Commander of the French Navy in the Indian Seas, dated 25th October last, expressing his thanks for the honor done him in admitting him as an honorary member of the Society.

From Messrs Alexander Adie and Son, dated Edinburgh, 9th September last, enclosing an invoice and bill of lading of Instruments shipped on board the 'Equestrian.'

From H. E. Goldsmid, Esq., Secretary to Government, Secret Department, No. 20, dated the 29th ultimo, requesting that Government be furnished with a copy of the Society's publication for transmission to the Honorable the Court of Directors.

From H. E. Goldsmid, Esq., Secretary to Government, Political Department, No. 4989, dated 31st October last, acknowledging the receipt of the Society's letter, No. 92 of the 30th ultimo, and of the Society's Transactions forwarded therewith, and requesting that the Society will have the goodness to supply Government with two copies of its future Transactions for transmission to the Hon'ble the Court of Directors and to the Board of Commissioners for the affairs of India.

From R. T. Reid, Esq., Secretary to the Managing Committee of the Students' Literary and Scientific Society, dated 2nd instant, acknowledging the receipt of the Society's letter of the 30th ultimo, No. 91, with a complete set of Transactions of the Society, and expressing the best thanks of the Dnyanprasarak Library's Committee for the Society's very valuable donation.

From Captain J. Willoughby, dated Poona, 2nd instant, acknowledging the receipt of the Society's letter of the 28th ultimo, and returning his best thanks for the honor done him in electing him a member.

From E. Roberts, Esq., dated Surat, 8th instant, enclosing copy of observations taken at Surat during the month of September last.

From N. A. Dalzell, Esq., dated Vingoria, 29th ultimo, informing of his having transmitted to Bombay per Pattimar three (3) cases containing Anemometers, &c., returned by Major LeGrand Jacob, Political Superintendent.

From H. E. Goldsmid, Esq., Secretary to Government, Political Department, No. 5044, dated

5th instant, transmitting copy of a letter, No. 357, dated the 12th ultimo, from the Political Agent in Kattiawar, and its enclosure, relative to the Storm which occurred in that province towards the end of July last.

From Major LeGrand Jacob, No. 457, dated 7th instant, requesting to be informed whether the Society can supply him with certain instruments to complete the list desired by Government for the meteorological Observations taken at Vingorla by the Civil Surgeon there. Also informing of his having received the Society's Barometer with attached thermometer, in charge of Major DelHoste at Phoonda Ghat, and delivered over to Mr. Sub-Assistant Surgeon Spencer Observations since 1st July have been made by it, and handed up to Government: those of Major Jaco b will be forwarded shortly when copied; and there seemed no necessity for the same to be continued, as one set for the same place wil be all the Society can wish for.

From J. G. Lumsden, Esq., Secretary to Government, Marine Department, No. 1142, dated 12th November instant, informing that under the authority of the Government of India, the Right Honorable the Governor in Council is pleased to sanction the grant of Rupees one hundred and twenty to Mr. Leech, as remuneration for his services in keeping the Tidal and Meteorological Observations at Manora in Scinde, and stating that the Paymaster at the Presidency has been authorized to disburse the amount.

From R. Clarke, Esq., honorary secretary to the Royal Asiatic Society, dated London, 2nd March 1850, acknowledging the receipt of the Society's Transactions from 1836 to 1849, inclusive, and expressing the best thanks of the Society for the same.

From Major LeGrand Jacob, dated Sawunt Warree, 12th November instant, forwarding the Meteorological Observations for the month of January, February, March, April, May, and June, taken at Sawunt Warree, as promised by him in the concluding paragraph of his letter of the 7th instant, No. 457 of 1850.

From D. F. McLeod, Esq., dated Camp Hurriana, Sutlej Territories, 11th November instant, acknowledging the receipt of the Society's letter, informing him of his election as a member of the Society.

PAPERS.—Meteorological Abstract taken for the month of September 1850, at Aden.

Ditto	Ditto	Ditto	Sattara.

Ditto ditto for the months of July, August, and September, taken at Surat.

Ditto	Ditto	Ditto	Dharwar.
Ditto	Ditto	Ditto	Hydrabad.
Ditto	Ditto	Ditto	Palunpoor.
Ditto	Ditto	Ditto	Bhooj.
Ditto	Ditto	Ditto	Alibaugh.
Ditto	Ditto	Ditto	Broach.
Ditto	Ditto	Ditto	Rajkote.

Ditto for the months of June, July, and August, taken at Larkhana.

Ditto ditto from February to September, taken at Baroda.

Ditto ditto from January to June, taken at Sawunt Warree.

Ditto for September, taken at Calcutta.

BOOKS.—Annual Report of the Grant Medical College for the Fourth Session of 1849-50. Presented by C. Morehead, M. D., Superintendent of the College.

Colonel Sykes' Paper on the Meteorology of India. Presented by the author.

Journal of the Royal Asiatic Society of Great Britain and Ireland, Vol. XII., Part 2nd. Presented by the Society: with a letter from R. Clarke, Esq., honorary secretary, dated 2nd March 1850.

Juggonath Sunkersett, Esq., proposed by the Honorable J. P. Willoughby, Esq., and seconded by Commander Griffith Jenkins, I. N., and Lieut. John Wray, proposed by Colonel Neil Campbell, and seconded by the Hon'ble J. P. Willoughby, Esq., were balloted for and unanimously elected members of the Society.

P. W. LeGeyt, Esq., proposed by Manockjee Cursetjee, Esq., and seconded by Lieut. Col. J. Holland, and Lieut. C. W. Walker, proposed by the Honorable J. P. Willoughby, and seconded by Captain H. J. Barr, will be balloted for at the next monthly meeting.

The meeting then adjourned.

The Ordinary Meeting of the Bombay Geographical Society took place on Thursday the 19th Dec. 1850.—The Hon'ble J. P. Willoughby, Esq., in the chair. Present,—A. Malet, Esq.; Manockjee Cursetjee, Esq.; Commander G. Jenkins, I. N.; T. J. A. Scott, Esq.; Dr. B. A. Bremner; Captain J. Estridge; T. L. Jenkins, Esq.; Venayekrao Juggonathjee, Esq.; and Dr. George Buist, Joint Secretary.

There were no papers before the meeting, and the only matter of business under discussion was the final consideration of the revised Bye-Laws as sent up approved by the Committee on Papers. Commander Jenkins having stated that he considered the proposed laws superfluous, as calculated to restrict the powers of committees, it was stated that all the bye-laws had in view was, to define the duties of committees, and prescribe certain forms of proceedure as imperative, which had on some occasions been overlooked, to the great injury of order and retardation of business. After some discussion, and several curtailments of what were deemed redundancies, the Bye-Laws were agreed to unanimously, with the exception of the second, to which Commander Jenkins objected. It was agreed that they should as amended be placed on record, and held as valid for the future guidance of committees—there seemed no occasion to print them. The following letters were then placed on the table:—

From Dr. Costello, Civil Surgeon Poona, reporting his having sent a barometer in charge of Mr. Hewett's biggaree, and enclosing a set of Meteorological Observations for September and October 1850, taken by himself in company with Mr. Newton.

From Mr. Dhunjeebhoy Framjee, requesting a copy of Herschel's Admiralty Manual.

From Rustomjee Pestonjee, sending the price of a copy of the Society's Transactions, Vol. ix., on account of Dr. Gibson.

From Major Jacob, requesting to be supplied with certain instruments.

From Dr. R. Haines, M. D., requesting to be furnished with a copy of the Society's Transactions, and intimating that any future communications to him should be made to the care of Dr. Coles, Assistant Surgeon.

From Dr. J. E. Stocks, Hydrabad, enclosing a Hoondee for Rs. 115, on account of instruments supplied to him by the Society.

From Messrs. Smith, Elder and Co., acknowledging the receipt of a letter from the Society, acquainting them of their having transmitted two parcels to their address, and on their arrival ordering them to send them to their destinations, and promising to act in future as the Society's Agents in that country.

From Mr. W. D'Oyly, Dhoolia, enclosing a Hoondee for Rs. 25, being half the amount in advance for a Mountain Symplesometer.

From Government, granting the services of Mr. Mayes.

PAPERS ON METEOROLOGICAL OBSERVATIONS.

From Oóconada for the months of September and October.
From Cuddalore for October 1850.
From Calcutta for ditto.
From the Observatory at Trevandrum for September 1850.
From Assistant Surgeon Wiehe, Sattara, for October.
From Kurrachee for August, September and October 1850.
From Poona for September and October 1850.

It was stated in reference to the letter of Government sanctioning the request of the Society in reference to the services of Mr. Mayes, that Mr. Mayes was now busily occupied in passing his own observations through the press—of late he had prepared a table of the fall of rain throughout the whole year for all parts of India, in so far as observations on the subject extended, and that he would probably proceed to Kurrachee in charge of the tide-gauge stand which had been made at the School of Industry by order of the Military Board, and there get matters started,—the difficulty generally experienced in such things being that of making a beginning. He would proceed to Aden as early as possible, and bring away all the instruments not required for the use of the civil surgeon at the station, who would hereafter conduct observations for the use of Government on a more restricted plan. The Secretary stated that at a former meeting, at which he was not present, it had been suggested that Government should be asked to afford Mr. Mayes a free passage to wherever his services were required: had he been present, he would have pointed out that Government had promised, so far back as 1846, to give any one the Society might depute to any station whatever where an observatory was proposed to be established, a free passage, provided any of their vessels were proceeding to the port: there was no occasion to make a fresh application, as there was no doubt that the promise then made, on which it had never been found requisite to act, would be fulfilled the moment it was recommended to Government: it would be time enough to do so when Mr. Mayes was ready to start. Of the three large wind-gauges that would be at command when the Aden establishment had been broken up, and the disposal of which had been entrusted by Government to the Society, one had been recommended by the committee on physical research to be sent to Poona,—the other two remained to be alloted to some other localities. Commander Jenkins stated that in a correspondence he had lately had with Mr. Daniel Webster, of the United States, much anxiety was expressed for information as to the tides and winds at Zanzibar, with the view of tracing what connexion existed betwixt them and those at the Mauritius, and how they were influenced by disturbances in the hurricane tract. It was stated in reply, that the Society had been much disappointed in not having been able to communicate with the Apothecary lately sent from Bombay to Zanzibar,—who had left the presidency before they were aware of his intended departure: it was their wish to have had observations both there and at Johana, where assistance was at their command, right in the tract enquired after by Mr. Webster—in this hitherto they had been disappointed. The Secretary was directed to address the British Resident at Zanzibar, Major Hamerton, on the subject, and make him aware of the plans and wishes of the Society, and request his influence with the Imaum, with a view to their promotion. He was desired also to communicate with Mr. Meldrum, Royal College, Mauritius, who had already written him on the subject of instruments, and with the Secretary of the Ceylon Society, with the view to securing their co-operation. On placing the paper by Colonel Sykes, just published in the Philosophical Transactions, before

them, and of which 500 copies had been desired by the Court of Directors to be sent out for the use of meteorologists at the different presidencies, the Secretary pointed out that the barometric curves at the conclusion were copies from those on the walls of the Society's Library—duly acknowledged;—he also noticed that the papers he had formerly laid before them on hail-storms and on meteors had been deemed worthy of being read before the British Association, and would appear in their Transactions. He mentioned these things, as a difference of opinion seemed to prevail on the spot on the value of the enquiries under consideration: the Royal Society and British Association were of the same views as the majority of the Bombay Society.*

In reference to the letter of Government, in which it was intimated that the question of the purchase or return of the instruments belonging to Government now under charge of the Society, had been referred to the Court of Directors, it was stated that this was the shortest and simplest means of getting the Admiralty grant made in some way or other available—that meanwhile the Society would go on with its work as before. Attention was directed to the excellence of a set of observations by Dr. Don at Kurrachee—the first they had received through Government where all the conditions had been attended to.

* The matter, like many other of the occurrences, has been omitted in the *Athenæum's* notice. The following extract is from a letter of the Secretary to the Association:—"Your collection of hailstorms was sent me by Professor Powell to show off at Edinburgh, and did I not astonish the lieges by thumping their brains with hailstones as big as their fists? I will send you what I said on your part when printed."—Professor Powell's analysis of the list of meteors appears in the published notices of the Transactions.

The Ordinary Monthly Meeting of the Bombay Geographical Society took place in their rooms, on Thursday, the 23rd January 1851, the Hon'ble J. P. Willoughby, Esquire, President, in the Chair.—Present: A. Malet, Esquire, Chief Secretary to Government; Commander Jenkins, I. N.; Captain H. J. Barr; John Smith, Esquire; Juggonath Sunkersett, Esq.; Venaikrow Jagonathjee, Esq.; and Dr. G. Buist, and Professor J. Patton, Joint Secretaries.

The minutes of last meeting were read and approved of. In reference to the instructions given to the Secretary on the subject of obtaining meteorological information from Zanzibar, the Mauritius, and Ceylon, it was stated that Major Hamerton, the Resident at the Court of H. H. the Imaum of Muscat, had been written to in terms of the instructions of the Society; that the communications desired to be addressed to the Secretary of the Ceylon Society, and to Mr. Meldrum of the Royal College Mauritius, had been delayed until the arrival of the instruments belonging to the Society intended for distribution: these had just been received, and the letters in question would be dispatched without delay. The Military Board required to be communicated with on the subject of setting up the Self-Registering Wind and Rain-Gauge at Poona. The Commissariat had taken charge of the Tide Gauge Frame for Kurrachee; and Mr. Dalzell had written stating that the new pier at Vingorla supplied an eminently suitable place for the tide-guage at the station, for which it had hitherto been most difficult to provide a suitable locality. Mr. Mayes, on his return from Aden, would be dispatched to set the operations at all these places agoing.—The report of the Committee on Papers on the recommendation of Dr. Ford, that the Paper of Colonel Sykes on the Meteorology of India should be reprinted from the *Philosophical Transactions*, being brought up, it appeared that the Committee recommended that instead of a reprint of the Paper, which would cost some Rs. 300 or Rs. 400, being considered desirable, Government should be applied to for such

supplies as could be conveniently spared by them of the 500 copies of the Paper about to be forwarded by the Court of Directors to India for the service of meteorologists. Dr. Ford was not aware of this having been intended, at the time his proposal to the Committee was made.—Dr. Buist stated that as a considerable number of mountain thermometers and anemometers of the former consignment of instruments remained unsold, and as the funds of the Society were never meant to be taxed in providing instruments for those desiring them, that a small percentage should, if found requisite, be laid on the price of the present invoice of instruments, which had also arrived in perfect safety, very favorable terms having been allowed by the makers in consequence of the magnitude of the order; also that the instruments should be detained for a week or two until time should be allowed for the half-hourly ratings for twenty-four or thirty hours of the barometers, sympiesometers, and aneroids. They had been thus rated on two previous occasions, and great interest was experienced by meteorologists at home in the results. It seemed most singular that two barometers as nearly as possible identical in structure, should, when hung side by side, correspond exactly at certain hours of the day, and a few hours after be found to differ two or three hundredths of an inch from each other. Both suggestions were assented to.

Mr. John Smith stated that in 1849 the following report, which he would read to the meeting, drawn up by a Committee of the Congress of the United States, had been presented to Congress, and its recommendations complied with:—

"Lieutenant Maury has undertaken to collect from the log books of both private and public ships, the results of the experience of their officers with regard to winds, currents &c., in all parts of the ocean, and to embody these results in a set of charts called 'Maury's Wind and Current Charts,' in such a manner as to give to every navigator the benefits of the experience of all whose records are thus combined and collated.

"For this purpose, the track of each vessel is delineated on the chart, in colours according to the seasons of the year, and in characters according to the months. The winds daily experienced by the vessel making the track are laid down on that track in symbols so ingeniously contrived, that the navigator, without any written description, sees at once not only the direction of those winds in the different months of the year, but perceives at once their precise character. They are seen to be fresh or light, moderate or strong, gales or squalls.

"In like manner he is apprised of the set and velocity of the sea currents, the variation of the compass observed, the temperature of the water, and such other facts as may have been noted; all tending to a more general and correct knowledge of wind and weather, and thus furnishing new helps towards making ocean navigation more safe, speedy and sure.

"In consequence of his investigations, Lieut. Maury has been induced to recommend a more northerly route than the one usually taken by vessels in the European trade. This recommendation is made not only on the principles of great-circle sailing, as being nearer, but also on account of the winds, which are in that region believed to be more favourable. The log book of Captain Mumford, of the ship *Wisconsin*, lately arrived at New York from Liverpool, has been, with many others, exhibited to your committee. The *Wisconsin* had Lieutenant Maury's charts on board, and kept well to the north, as recommended by him. She arrived at her port of destination twelve days before two other ships which sailed in company, but which went further to the south. It is not claimed that such a difference will invariably occur in the length of passage by the two routes, but the result we record is nevertheless full of significance, and indicates the great importance and value to be attached to the subject under con-

sideration. If the voyage across the Atlantic can be shortened but a day or two, commerce will still reap important benefits.

"But results far more important than these have already arisen from examinations made at the National Observatory. After carefully comparing the log books of many thousand vessels sailing between the United States and Brazil, China, the Indies, the Cape of Good Hope, and Cape Horn, the author of these charts has been led to the important discovery that the circuitous course usually taken to these places may be avoided. It may here be remarked, that the usual route of vessels bound from our Atlantic coast to the ports of the world we have named, is nearly the same until they reach the equator. But these charts indicate an entirely new route thither. The usual course of our vessels bound to Rio Janeiro, or the Cape of Good Hope, is across the Atlantic Ocean to the shores of Africa, thence to the coast of Brazil, and if bound to the Cape, a third time across the ocean This zigzag course has been hitherto pursued, in the belief that in following it better winds have been found than if any other had been taken. The facts derived from the log books and records of a thousand ships show this belief to be unfounded.

"It has been made to appear to the satisfaction of your committee, that monsoons, or trade winds, prevail in that part of the Atlantic through which a part of the old route to the equator lies, where no such winds have been thought to exist. From June to November, inclusive, these winds prevail from the southward and westward. And they are exactly in that part of the ocean where, strange though it may appear, vessels ever since the days of Cook and Cavendish have been in the habit of going, with the expectation of finding winds favourable for a course to the southward and westward.

"In consequence of results like these, Lieut. Maury was led to examine the materials his own industry had accumulated, in order to find a better route. Accordingly one was discovered and announced, which, besides being several hundred miles nearer, lies also through a region of more favourable winds; insomuch that the average passage of a number of vessels which have tried this new route during the last year is ten days, or about 25 per cent. less than the average by the usual course to the equator.

"A still further examination of the materials at his command has led Lieutenant Maury to other promising results. By projecting the courses of large numbers of vessels engaged in the trade of the Gulf of Mexico, and noting the currents they have met with, it has been made to appear more than probable that a current has been discovered, which (if found to exist) will shorten the usual sailing distance from Havanna to New Orleans, and to other ports in the States bordering on the Gulf, nearly one-third. By the route usually pursued, vessels have to encounter an opposing current running at the rate of near sixty miles per day. It is believed that, by following along the Cuba Shore, vessels bound to New Orleans will find a current in their favour of equal velocity.

"Lieutenant Maury states that the materials collected, and now on the file at the Observatory, have led him to expect another discovery of great importance to commerce. By closely examining the observations he has prevailed on navigators to make, he finds good grounds for the belief that the gulf stream divides its waters on the banks of Newfoundland, and that there is, thence to the European side of the Atlantic, cold and warm currents running counter to each other, the one favourable to the outward bound, and the other to the homeward bound vessel.

"The prayer of the memorialists is deemed reasonable by your committee, and we believe their wishes should be promptly granted. As owners and masters of American merchantmen, they have voluntarily agreed to make observations in every sea, according to a uniform system

prescribed by the superintendent of the National Observatory, and to forward them to him for examination and publication.

"They have undertaken to do this, not only for their own private advantages, but they are actuated by the higher motive of desiring to contribute to the stock of general knowledge on this subject, and thus to promote the cause of physical science and to benefit commerce and the world. It is a work in which mankind is interested, and which, therefore, fairly claims the active co-operation of a government whose peculiar mission it is to advance and protect the interests of the people. Yet the memorialists only ask that government shall lend its aid to an enterprise which tends as much to national as to individual advantage. They do not ask that it shall do that for commerce which commerce may properly do for itself. They ask that where the mercantile marine points the way, and makes or indicates valuable discoveries, which trading ships cannot stop to examine—that there the national vessel shall follow, to verify, perfect, and systematize, their investigations and observations.

"The water thermometer alone kept by private ships in conformity to the request of Lieut. Maury, has pointed out one valuable discovery, to which allusion has already been made. It has indicated the existence of the cold and warm currents running in opposite directions between this country and Europe. This instrument is an unerring index of great value. It was by its use that the gulf stream was discovered, which discovery produced one of the most remarkable changes in the course of trade known to modern times.

"By his own efforts, and his well-timed appeals to the intelligence and patriotism of American ship-owners and masters, it appears that Lieutenant Maury has engaged their voluntary co-operation, and that hundreds of them are now occupied in all parts of the ocean in making the observations required to carry out this undertaking. And it is believed your committee are safe in saying, that such a corps of observers were never before engaged in any field whatever of scientific and useful research.

"Seeing the advantages thus promised to commerce and navigation, few American Ship-masters now put to sea without a copy of these charts, and a tender of service to collect and forward to the National Observatory the materials required to make them complete. The Wind and Current Charts are regarded by all who have had their attention directed to the subject as among the most useful fruits of modern investigation. So far, they are the work of an individual. Their conception and construction originated, we believe, with Lieutenant Maury. They are the valuable products of an earnest inventive and scientific mind yielded to public use without restriction of any sort."—London Athenæum, May 26, 1849.

A large body of the Merchants and Ship-Owners of Bombay having had this brought under their consideration, resolved to raise a subscription for the construction of a set of Charts on Lieut. Maury's plan, and to endeavour to do for the Indian seas what he had done for the Atlantic. The requisite funds having been most promptly contributed, an agent was found in Mr John McFarlane, formerly an officer in the merchant service, and at this period assistant Secretary to the Geographical Society,—a gentleman whose labours had frequently met with the approbation of the Society. While Mr Maury's principle had been strictly adhered to, a slight departure from his details had been deemed requisite. That gentleman had given all the tracks for the year ruled on a single sheet, distinguishing those of different seasons by separate colours: so numerous were the tracks on some of the sheets already, that the maze they produced was bewildering—they could with difficulty be followed by the eye, and the complication became encreased by every year's additions. To avoid this, four sheets, corresponding to the seasons of the year, had been made use of, so as to allow the utmost latitude for the projection of tracks, and avoid all risk of confusion. The charts extended from the

Cape of Good Hope to the Philippine Islands, including the great hurricane tracks and the seas most frequented by merchantmen; they had all been reduced to the same scale, and that was a large one—five sheet being allowed for the charts of each season, or twenty in all: there were three extra charts, twelve sheets more, for the Australasian seas, on which but a few tracks had been delineated. There were thus twenty-two sheets in all, on which thirty-five tracks had been laid down, taken from the logs of the following vessels trading with the port of Bombay :—

Falcon, 1849,48 ; Lowjee, 1834,33,37,32,35 ; Frolic, 1848,49,46,47 ; Buckinghamshire, 1848,49,47 ; Elora, 1847,49 ; H. C. Ship Fort William, 1818 ; Martin Luther, 1849,45,46,44,48, 47,40,50 ; Hannah, 1829 ; Ferozepore, 1847,48,49 ; Balcarres, 1842,45 ; City of Poona, 1830,40 H. C. S. Hugh Lindsay, 1817,16 ; Fort William, 42 ; and Dumfries, 1837.

The subscribers proposed placing these at the disposal of the Geographical Society, provided they undertook to arrange for their publication ; reserving to themselves the power of withdrawing them and seeking some other means of making them available to the world should they chance to be declined by the Society. In their present state they were of course merely skeletons—the delay likely to be incurred in making them more complete while in the hands of an individual at Bombay, threatened to be such that the best plan seemed to be to have them lithographed as they were, and to place copies in the hands of naval men frequenting these seas from whatever port, so that those for whose service the charts were designed might assist in extending and preparing them. This was exactly the plan pursued by Lieutenant Maury, and hundreds of contributors would thus at once be secured, all labouring simultaneously and for the same end. As each chart received additional tracks through this means, it would be, as occasion offered, placed in the hands of the Society to transfer all the tracks projected to one common set of charts retained at the Presidency on purpose ; and so soon as the new tracks became numerous enough, the charts would be a second time sent to press : further editions with fresh information being issued periodically as circumstances permitted. Mr Smith stated that he had no doubt whatever that if the Charts were once ready for publication they would be purchased with avidity—that no Captain would indeed go to sea without them ; and that a fund would thus speedily arise for further publications, or for promoting the general plans of the Society in this division of their labours.

Commander Jenkins stated that he was opposed altogether to the views of Mr Smith : he did not consider the funds of the Society sufficient to bear the load proposed to be imposed them. The Charts now produced had been prepared by a gentleman altogether unknown to them, and who knew nothing of their wants ; whereas one of their own Members, a very distinguished officer, Lieutenant Taylor, I. N., had of late been engaged in preparing a set of first-rate Charts of the greatest value, which it would be greatly preferrable to publish.

The Hon'ble Mr Willoughby stated that he did not see that there was any conflict whatever betwixt the views of Mr Smith and those of Commander Jenkins. There was no reason why one set of Charts should be depreciated because another was being brought into existence —the Society ought to be but too happy to avail itself of everything of this sort within its reach. It appeared to him (the President) that the Charts prepared by the Merchants were of so great public value that should the Society decline them, they ought to be offered to Government, who he had no doubt would appreciate them as they deserved to be appreciated.

Mr Smith stated that this was exactly the alternative in contemplation. The subscribers had determined first to offer them to the Geographical Society, as the most natural and fitting channel of communication with the public, and as furnishing the most obvious means of carrying out the further extension and improvement of the charts, with a view to their subsequent issue : they were under the impression, also, that by undertaking such a task as

that proposed, the Society would be labouring within the proper sphere of its exertions, while it was extending its name as an organ of geographical research throughout the world. Should the Society decline the charts, it was intended to offer them either to the Bombay Government for the service of the Hon'ble East India Company, or to H. M.'s Lords of the Admiralty.

Commander Jenkins stated that he in that case saw no objection to the acceptance of the charts, provided the charge for publication was not taken from an improper fund. The following motion was then put and agreed to unanimously:—

Proposed by J. Smith, Esq., seconded by Capt. Barr—

"That a Committee consisting of the following, be appointed to take into consideration the best means of preparing for publication a set of Wind and Current Charts, placed at the disposal of the Society by the Merchants of Bombay:—Commodore Lushington, Captain Hawkins, Colonel Holland, Captain Jenkins, John Ritchie, Esquire, J. Smith, Esquire, and the Secretaries ex-officio.

This matter having been disposed of, Mr Patton proceeded to lay before the Society an account of a very ingenious instrument just constructed by him for measuring the pressure of the atmosphere. It was on the principle of a sympiesometer, mercury being made use of in place of oil, and common air instead of hydrogen gas. Mr Patton's explanations seemed greatly to interest the Meeting, and he was requested to prepare a paper on the subject, which he promised to do so soon as some further experiments he had in hand on the subject should be completed.

A very ingenious Rain-Gauge by Mr de Blaquiere was presented to the Society:—its indications were made by a dial-plate and index-hands, like those of a clock—it read to thousandths of an inch.

The Instruments just received were then exhibited to the meeting. Not a single accident had occurred to any of them, and they were all in perfect order. A slight change had been made on some of the Mountain Barometers, getting rid of the capstan-headed pin, and pinion and ratchet, by which the vernier was adjusted,—and introducing in its place a singularly neat and ingenious ring-slide, with a screw embracing the barometer, and completely out of the way of injury. The other instruments consisted of Mountain Thermometers, Aneroids, common Thermometers, and others for special purposes, with a high range and degrees subdivided,—Pocket Magnifiers &c. It was stated that the bulk of the instruments had been ordered: so soon as the prices of them were realized, a further order was directed to be sent home.

Dr Ross was elected as a member of the Society.—To be balloted for next meeting: Cursetjee Jamsetjee, Esq., proposed by the Hon'ble J. P. Willoughby, Esq., and seconded by Juggonath Sunkersett, Esq.; and Manockjee Limjee, Esq., proposed by Commander G. Jenkins, I. N., and seconded by Dr Buist.

The following letters, books, &c., were then laid on the table, for which the thanks of the Society were directed to be tendered:—

LETTERS.

From Assistant Surgeon Murray, Sukkur, dated 19th December 1850, requesting to have forwarded to him his pair of self registering thermometers through Lieutenant Ballingall.

From Messrs Smith, Elder and Co., London, dated 19th November 1850, informing of their having distributed copies of the Society's Transactions Vol. IX. to the parties severally addressed, except those of Paris, Munich, and Cairo.

From Mr Barlow, Secretary to the Royal Institution, dated 1st November last, returning

thanks of the members of that Institution to the Society for their present of a copy of their Transactions, Vol. IX.

From Mr Cunningham, Secretary King's College London, dated 1st November 1850, conveying the best thanks of that Institution to the Society for a present of their Transactions, Vol. IX.

From Lieutenant Colonel Melvill, Secretary to Government Marine Department, dated 3rd instant, acknowledging the receipt of the Society's letter of the 2nd instant, and acquainting them of a request being made to the Commander in Chief of the Indian Navy to furnish Mr Mayes with a free passage to proceed to Aden by that day's Mail.

From Messrs Smith, Elder and Co., London, dated 7th December last, informing of their having completed the delivery of the Society's Transactions, and enclosing a memorandum of their disbursements.

From Messrs Denny, Clark and Co., London, of 7th December last, enclosing a Bill of lading for a case shipped per *Sutlej*, containing a portrait of the late Captain D. Ross, and 3 Tablets. Also annexing a Memorandum of the charges incurred thereon.

From Captain G. Wingate, Dharwar, dated 7th instant, enclosing a cheque for Rs. 15, on account of his subscription.

From Corporal R. Leech, requesting to deposit the amount of Rs. 120 in his name in the Bombay Bank.

From P. W. LeGeyt, Esq., presenting thanks to the Society for the honour done him in electing him a member.

From A. Malet, Esq., Chief Secretary to Government, Secret Department, presenting from the Right Hon'ble the Governor in Council an account of the City and Province of Peshawur, by Lieutenant Raverty, 3rd Regt. N. I.

BOOKS.

Observations made at the Meteorological Observatory of Hobart Town, Van Diemen's Land, prepared by Colonel Sabine. Presented by H. M. Government.

Beke's enquiry into D'Abbadie's Journey to Kaffa. Presented by the author.

Journal of the Royal Geographical Society of London, Vol. XX. Presented by the Society.

Bulletin De La Societe De Geographie.—Journal Asiatique ou Recueil De Memoires, Tome XIV, 2 parts and Tome XV.

PAPERS.

From the Observatory at Trevandrum, Hurryhur, stations of Mercara, and Bangalore, Bhooj, Dharwar, Alibaugh, Ahmedabad, Broach, Meteorological Abstracts for the months of October and November. From Coconada, Calcutta, Sattara, Port of Cuddalore, stations of Kamptee, Cuddalore, Chittoor, cantonment of St. Thomas's Mount, Civil Dispensary Nellore, for the month of November.

From the stations of Cuddalore, Kurnool, Secunderabad, Kamptee, Guntoor, and Chittoor, cantonment of St. Thomas's Mount, Zilla Mangalore, Garrison of Cannanore, for Oct. 1850.

From Shikarpoor, Sawant Warree, Bushire, for the months of July, August, and Sept. 1850.

From Aden for October.

From Bhooj, Dharwar, Sattara, Alibaugh, for the month of December 1850.

THE Bombay Geographical Society held its ordinary monthly meeting in its rooms, in the Town Hall, on Thursday the 20th February. Present:—The Honorable J. P. Willoughby, Esq., President in the chair; A. Spens, Esq.; Captain P. T. French; Commander G.

Jenkins, I. N.; John Smith, Esq.; Manockjee Cursetjee, Esq.; Jaggonath Sunkersetjee, Esq.; Venayekrow Juggonath, Esq.; Dr. G. Buist, and Professor J. Patton, Joint Secretaries.—Mr. Mackay, Commissioner for Cotton Enquiries, was introduced by Mr. Smith as a visitor.

The minutes of last meeting having been read and approved of, the Secretary stated that since then, letters had been written to the Military Board on the subject of the erection of a Wind-gauge at Poona, to Mr. Meldrum, of the Royal College at the Mauritius, and the Secretary of the Asiatic Society of Ceylon, making them aware of the researches of the Society, and requesting their co-operation. The instruments had all been subjected to twenty-four hours' comparative readings, and were now in course of being dispatched to the parties who had ordered them; and the instructions of the Society in other matters carried into effect.

The first business before the Meeting was the motion of Commander Jenkins:—

That the Printing of the Transactions of the Bombay Geographical Society be transferred to the Government Printing Press at Byculla, where the Orphans of European Soldiers that have been educated at the Byculla School are instructed in the trade under an able superintendent.

Commander Jenkins stated that his sole object in bringing the motion before the meeting was with the view of benefitting a valuable public establishment. From the minutes made by members of the Society on the circular sent round, it appeared that there were difficulties in the way of carrying his views into effect which had not occurred to him, and that the Byculla establishment stood less in need of their support than he supposed. He begged leave therefore to withdraw his motion. (Leave granted.)

Dr Buist stated that in 1843, when the first large collection of Barometers of similar form brought to Bombay for the general purposes of meteorology, had been at his disposal, he had got readings of them made at the Observatory of which he was then in charge, when eight barometers had been read half hourly for the space of twenty-four hours on end. One of the objects of this at the time, was to test the condition of the standard at the establishment, which was suspected to be out of order, but with which, as there was no duplicate to be had, and as it was large and cumbrous, it was considered inexpedient to meddle until other instruments were at command. It turned out in reality, that the standard contained an air bubble, and its readings had been till then above a tenth of an inch too low. The experiment had been quoted by Colonel Sabine at the British Association in 1845, as furnishing the first correct data for the atmospheric pressure of Bombay. Other results of much importance had sprung out of it, and it was found that a set of barometers of the same form, made by the same maker, with tubes of the same glass, and filled with the same mercury,—in fact, with the most perfect identity in all things that could be secured —when hung side by side differed from each other by several hundredths of an inch more at one point than at another. A second opportunity of repeating the experiment occurred in May 1850, when the society's first importation of instruments arrived: the results of the experiment then made were published in their report, but the same assistance was not on this occasion available, and two of the three parties who shared in the readings had not experience enough to make them be altogether depended on; and though it could not be asserted that the readings were incorrect the discrepancies were so very great as to impair faith in their accuracy. Fortunately Mr Mayes had been placed at their disposal by Government about the time of their last batch arriving, and in his care and correctness the most perfect dependance could be placed, and the present experiment therefore was as interesting and important as that of 1843. The discrepancies were in this case less notable than in the previous one—were so slight in fact as to indicate the very admirable construction of the barometers; but they were still such as to show that the instrument was not entitled to claim that implicit reliance that had

generally been placed upon it. When instances were quoted of elevations determined by the theodolite and the barometer agreeing to within a few feet of each other, as illustrations of the length to which accuracy might be carried, there might in reality be very little merit due to any one—the coincidence being matter of accident, and in not one experiment out of ten would the same results be attained by the same observer, making use of the same instruments under circumstances as nearly as possible identical. The error might not be very great, but it was well to know that it was impossible to provide against the elimination of error altogether. The experiment bore on another point: in the examination of that very ill understood phenomenon, the daily fluctuation of the barometer, it was considered matter of much importance to know at what rate the amount of tide decreased as we assended from the surface of the earth. The best experiments on this subject were those made simultaneous by Colonel Sykes at Poona and Dr Walker at Mahabuleshwar—the difference of level being 2500 feet; with those made at Madras, twenty feet, Trevandrum, 150 feet, and Dodabetta, 8500 feet, above the level of the sea, and those made at Aden by Mr Mayes on the Seerah Island, 180 feet, and on the top of Shum Shum, 1700 feet above the level of the sea. In this last case the tide at the higher point ought to be about one twentieth less than that of the lower: at Dodabetta, it ought to be one third less than at Madras, and less they were accordingly, in somewhat like these proportions; but until either better instruments than the best of our barometers were procured, or a much larger mass of observations than that now existing were accumulated, it would be unsafe positively to lay down the law on the subject. No sufficient explanation of these discrepancies had been given: Dr Ford ascribed them to the electric state of the barometric tube, to which very probably might be due. In want of explanation of their cause, it was well to be in possession of the fact of their existence. (See next page.)

The Aneroid is an instrument of so much value for survey purposes in India, that I have lost no opportunity of endeavouring to ascertain its trustworthiness, and in general the results of these inquiries have redounded greatly to its praise. An Aneroid appears to have been kept at the Colabah Observatory for the past twelve months, comparative readings of which with the Standard Barometer have been published in the Newspapers.

The following is an abstract of these for the whole of the year 1850. From this it will be seen that the range of the Aneroid which at the commencement of the year was close on that of the Barometer has towards conclusion been reduced to very nearly a fourth of that instrument. The standard Barometers at the Observatory are the finest instruments that can be made, and there seems no reason to doubt the perfect care and accuracy with which they are observed. Of the Aneroid in use I cannot speak, but it is observed, I presume by the same parties who read the Barometer, and has therefore likely to be treated with every justice. If under these circumstances the Aneroid is apt to deteriorate so fearfully, our faith in it must be materially modified, and those instruments only trusted which have before hand been subjected to long and careful examination. (See page xxxiii).

Barometers, Comparison of, made at Colaba, on the 5th and 6th February 1851. *Elevation above the sea* 37 *feet.*

		Standard Mountain Barometers.											N. ●	Aneroid Barometers.					Sympiesometers.				
Mean Time.	Atd. Ther.	No. 9 M.	No. 11	No. 12	No. 13	No. 14	No. 15	No. 16	No. 17	No. 18	No. 19	No. 20	Bar.	No. 4406	No. 4415	No. 4521	No. 4525	No. 4959	No. 2736	No. 2738	No. 2739	No. 2741	No. 2691 M.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
4	78·5	30·044	30·066	30.060	30·060	30·054	30·054	30.050	30·086	30·072	30·060	30·054	30·070	30.000	29·978	29·980	29 950	29·995	30·04	29·99	30·04	30·07	30·02
5	77·5	·078	·074	·068	·070	·072	·070	·064	·096	·100	·094	·080	·084	·011	·975	·990	.960	30·005	·05	30 01	·05	·11	·03
6	77·5	·080	·086	·080	·076	·082	·086	·076	·110	·114	·106	·088	·096	·020	·985	30·015	.975	·015	·06	·02	·07	·11	·04
7	76·7	·090	·104	·100	·086	·092	·092	·088	·130	·116	·112	·100	·106	·025	·990	·020	.990	·020	·07	·03	·08	·13	·06
8	78·8	·120	·123	·124	·126	·116	.116	·112	·150	·136	·126	·134	·138	·045	30·005	·035	30·020	·040	·10	·06	·11	·16	·09
9	80·8	·146	·156	·146	.148	·138	·144	·140	·156	·158	·164	·150	·150	·070	·025	·050	·030	·065	·11	·08	·12	·17	·12
10	82·0	·146	·156	·152	·152	·136	·150	·140	·170	·160	·144	·134	·154	·075	·015	·045	·020	·070	·09	·07	·11	·15	·10
11	83·5	·125	·130	·125	·120	·112	·118	·124	·126	·126	·116	·114	·134	·050	29·990	·025	29·980	·050	·06	·03	·08	·10	·08
Noon	84·0	·086	·075	·076	·093	·070	·076	·078	·092	·092	·078	·068	·090	·020	·975	29·980	·940	·020	·02	29·97	·03	·05	·03
1	84·0	·046	·035	·044	·040	·036	·032	·042	·058	·050	·044	·044	·056	29·975	·940	·960	·900	29·970	29·98	·94	29·98	·02	29·98
2	83.8	·020	·008	·010	·020	·006	·000	·016	·036	·028	·016	·016	·030	·955	·950	·925	·875	·950	·95	·92	·96	·00	.96
3	82·5	·010	·004	29·990	29·988	29·984	29·992	·002	·036	·020	·000	·000	·016	·960	·940	·920	·870	·940	·94	·90	·95	29·97	.94
4	82·0	·014	·010	30·000	30 018	30·006	·992	·012	·046	·032	·028	·022	·024	·950	·950	·950	·875	·950	·95	·91	·96	30·00	.96
5	81·0	·028	·024	·032	·026	·028	·036	·030	·050	·056	·048	·030	·030	.970	·950	·955	·900	·950	.97	·92	·98	·02	.98
6	80·5	·050	·054	·048	·060	·042	·052	·052	·070	·064	·070	·040	·060	·980	·960	·965	·925	·970	30·00	·95	30·01	·045	30·01
7	80·5	·058	·072	·060	·068	·052	·060	·060	·080	·070	·076	·072	·064	·990	·975	·970	·930	·975	·01	·97	·03	·07	·02
8	80·0	·086	·082	·080	·082	·074	·092	·076	·114	·100	·096	·090	·076	30·000	·980	·975	·950	30·000	·05	30·01	·05	·10	·06
9	80·0	·094	·100	·096	·090	·084	·100	·100	·128	·124	·106	·092	·080	·020	·990	·980	·974	·010	·05	·01	·05	·11	·06
10	79.0	·088	·112	·098	·088	·084	·096	·100	·108	·104	·102	·083	·084	·055	30·020	·990	·970	·010	·05	·01	·06	·10	·06
11	78·0	·088	·100	·106	·080	·080	·076	·086	·084	·096	·082	·078	·074	·020	29·980	·987	·985	·010	·05	29.99	·06	·09	·04
Mid-Night	77·5	·080	·076	·084	·080	·070	·076	·086	·080	·096	·065	·066	·074	·010	·978	·975	·970	·010	·05	·99	·06	·09	.06
1	77·0	·080	·076	·070	·080	·066	·074	·074	·076	·078	·060	·060	·074	·010	·977	·975	·965	·010	·05	·99	·06	·10	.06
2	77·0	·076	·070	·062	·074	·061	·063	·070	·072	·065	·058	·060	·070	·005	·970	·970	·965	·005	·04	·95	·05	·09	.05
3	76·8	·054	·060	·056	·064	·050	·058	·065	·070	·060	·050	·053	·058	29 990	·920	·970	.960	·000	·03	30·00	·40	·09	.04
4	76·5	·054	.050	·048	·052	·043	·050	·060	·077	·054	·046	·058	·042	30·000	·960	·960	.955	29·990	·04	·01	·07	·10	.05
Means.	79·8	30 047	30·075	30·073	30·074	30 065	30·071	30·072	30·088	30·084	30·077	30·071	30·078	30 012	29·975	29·982	29·965	30·000	30·03	29·99	30·05	30·08	30·03

Dr Buist laid two other papers before the Society—one on the decrease of the range of the Observatory Aneroid, which in January 1850 had not differed more than ·020 from the standard barometer, and which now ranged about ·040 when the standard ranged ·130. If the instrument was apt to deteriorate at this rate, it could only be relied on where the means of comparing it from time to time with the barometer were at command. The other paper was on the hourly increments and decrements of pressure at some half score of places betwixt the Tropics.

BAROMETER AND ANEROID COMPARISON, 1850.

The Aneroid is an instrument of so much value for survey purposes in India, that I have lost no opportunity of endeavouring to ascertain its trustworthiness, and in general the results of these inquiries have redounded greatly to its praise. An Aneroid appears to have been kept at the Colabah Observatory for the past twelve months, comparative readings of which with the Standard Barometer have been published in the Newspapers.

The following is an abstract of these for the whole of the year 1850. From this it will be seen that the range of the Aneroid which at the commencement of the year was close on that of the Barometer, has towards conclusion been reduced to very nearly a fourth of that instrument. The standard Barometers at the Observatory are the finest instruments that can be made, and there seems no reason to doubt the perfect care and accuracy with which they are observed. Of the Aneroid in use I cannot speak, but it is observed, I presume by the same parties who read the Barometer, and has therefore likely to be treated with every justice. If under these circumstances the Aneroid is apt to deteriorate so fearfully, our faith in it must be materially modified, and those instruments only trusted which have before hand been subjected to long and careful examination. (See page xxxiii).

Comparison betwixt the Standard and Aneroid Barometers made at the Observatory Colaba, betwixt January and December 1850, *with the range of each; showing the remarkable diminution of the Aneroid in the course of the year.*

JANUARY 1850.							FEBRUARY, 1850.						
	Barometer.		Range.	Aneroid.		Range.		Barometer.		Range.	Aneroid.		Range.
	Max.	Min.		Max.	Min.			Max.	Min.		Max.	Min.	
7	29.980	29·839	·141	29·90	29.80	·10	1	29·981	29·865	·126	29·88	29·80	·08
8	922	780	·142	85	72	·15	2	30·017	850	·167	97	80	·17
9	850	720	·136	81	69	·12	3		948			89	
10	861	742	·119	80	70	·10	4	059	927	·132	30·00	89	·11
11	929	798	·131	88	70	·08	5	050	928	·122	00	88	·12
12	908	800	·108	93	71	·22	6	026	876	·150	29 99	85	·14
13		791			70		7	027	882	·145	30·00	89	·11
14	875	755	·120	78	66	·12	8	019	908	·111	00	89	·11
15	910	790	·120	80	69	·10	9	053	901	·152	01	88	·13
16	931	798	·133	85	71	·14	10		902			90	
17	919	795	·124	82	72	·10	11	29·981	884	·097	29·96	87	·09
18	914	805	·109	82	74	·08	12	30 015	856	·159	99	86	·13
19	930	797	·133	83	74	·09	13	013	883	·130	98	85	·13
20		896			80		14	002	880	·122	99	83	·16
21	980	842	·138	88	75	·13	15	29·999	852	·147	96	82	·14
22	941	833	·108	84	75	·09	16	994	844	·150	94	80	·14
23	930	810	·120	81	71	·10	17		863			83	
24	929	726		81	70	·11	18	976	847	·129	30 00	83	·17
25	960	833	·127	81	72	·09	19	997	875	·122	95	93	·02
26	957	833	·124	87	75	·12	20	30·024	905	·119	08	98	·10
27		844			75		21	29·997	835	·162	04	90	·14
28	953	844	·109	87	75	·12	22	936	793	·143	00	88	·12
29	30·003	844	·159	85	80	·05	23	986	832	·154	01	93	·08
30	015	892	·123	90	80	·10	24	971	855	·116	02	93	·09
31	29·994	880	·114	90	80	·10	25		854			98	
							26	970	847	·123	02	93	·09
							27	986	857	·109	04	95	·09
							28	965	830	·135	01	92	·09

MARCH, 1850.

	Barometer.		Range.	Aneroid.		Range.
	Max.	Min.		Max.	Min.	
1	29·980	29·829	·151	29·03	29·92	·11
2	985	821	·164	04	90	·14
3		844			91	
4	954	823	·131	01	90	·11
5	952	820	·132	29 91	80	·11
6	927	800	·127	90	79	·11
7	988	850	·138	95	81	·14
8	962	818	·144	92	80	·12
9	972	794	·178	94	78	·16
10		873			85	
11	895	864	·031	95	84	·11
12	979	864	·115	95	84	·11
13	925	805	·120	90	79	·11
14	925	810	·115	90	80	·10
15	948	832	·116	91	80	·11
16	936	822	·114	91	81	·10
17		873			86	
18	971	828	·143	94	81	·13
19	978	844	·134	94	84	·10
20	942	794	·148	91	80	·11
21	922	808	·114	90	80	·10
22	941	812	·129	92	80	·12
23	991	849	·142	98	85	·13
24		907			90	
25	30·029	882	·147	30·01	90	·11
26	29·973	846	·127	29 98	85	·13
27	947	844	·103	95	86	·09
28	978	836	·142	98	85	·13
29	966	816	·150	95	84	·11
30	918	765	·153	97	81	·16
31		793			92	

APRIL, 1850.

	Barometer.		Range.	Aneroid.		Range.
	Max.	Min.		Max.	Min.	
1	29·886	29·783	·103	29·92	29·83	·09
2	907	818	·089	97	89	·08
3	933	816	·117	98	89	·09
4	947	787	·160	30·00	84	·16
5	896	782	·114	29·95	84	·11
6	926	755	·171	98	80	·18
7		782			84	
8	857	756	·101	91	81	·10
9	826	707	·119	87	74	·13
10	859	728	·131	88	80	·08
11	884	740	·144	90	79	·12
12	859	728	·131	88	76	·12
13	867	752	·115	90	81	·09
14		773			80	
15	861	773	·088	94	80	·14
16	904	779	·125	30 01	90	·11
17	894	780	·114	01	91	·10
18	883	783	·100	00	91	·09
19	903	795	·108	02	92	·10
20	895	777	·118	01	91	·10
21		831			88	
22	928	800	·128	07	94	·13
23	942	768	·174	08	91	·17
24	907	736	·171	06	90	·16
25	828	688	·140	29·98	85	·13
26	827	679	·148	98	84	·14
27	820	707	·113	97	89	·08
28		722			90	
29	849	725	·124	95	85	·10
30	852	741	·111	97	85	·12

MAY, 1850.

1	29·866	29.768	·098	29·98	29·88	·10
2	876	730	·149	98	85	·13
3	826	700	·126	92	82	·10
4	817	712	·105	90	82	·08
5		708			82	
6	840	708	·132	90	82	·08
7	832	734	·098	92	87	·05
8	890	767	·123	98	87	·11
9	852	713	·139	92	80	·12
10	853	730	·123	92	85	·07
11	821	686	·135	90	76	·15
12		747			82	
13	814	672	·142	89	81	·08
14	794	667	·127	88	77	·11
15	814	677	·137	89	78	·11
16	807	702	·105	90	80	·10
17	833	728	·105	94	81	·13
18	853	740	·113	92	81	·11
19		784			88	
20	890	752	·138	96	87	·09
21	852	715	·137	92	82	·10
22	822	706	·116	90	80	·10
23	820	691	·129	90	80	·10
24	816	669	·147	90	78	·12
25	798	654	·144	88	74	·14
26	783	659	·124	87	78	·09
27	758	678	·080	85	78	·07
28	764	673	·091	85	79	·06
29		642			72	
30	771	669	·102	88	77	·11
31	807	692	·115	90	80	·10

JUNE, 1850.

1	29·813	29·650	·163	29·90	29·83	·07
2		682			82	
3	755	650	·105	84	80	·04
4	746	649	·097	84	78	·06
5	710	610	·100	83	76	·07
6	670	560	·110	80	70	·10
7	681	582	·099	81	71	·10
8	606	586	·028	82	72	·10
9	658	569	·089	78	74	·04
24	680	601	.079	78	74	·04
25	685	596	·089	79	75	·04
26	706	607	·099	78	75	·03
27	775	595	·080	78	72	·06
28	701	619	·082	80	75	·05
29	710	646	·064	80	78	·02
30		611			73	

JULY, 1850.

	Barometer.		Range.	Aneroid.		Range.
	Max.	Min.		Max.	Min.	
1	29·682	29·617	·065	29·78	29.75	·03
2	765	644	·121	80	77	·03
3	801	737	·064	80	80	·03
4	804	720	·084	81	80	·01
5	768	698	·070	80	80	·00
6	757	697	·060	80	80	·00
7		642			75	
8	704	632	·062	78	75	·03
9	696	622	·074	78	76	·02
10	703	602	·101	78	75	·03
11	687	616	·071	77	75	·02
12	666	579	·087	77	74	·03
13	629	569	·060	75	72	·03
14		576			73	
15	646	574	·072	77	72	·05
16	582	488	·094	72	64	·08
17	581	505	·076	71	66	·05
18	597	499	·098	72	66	·06
19	669	559	·110	77	70	·07
20	680	612	·068	78	76	·02
21		590			74	
22	667	580	·087	76	74	·02
23	592	505	·087	72	66	·06
24	552	485	·067	70	66	·04
25	579	487	·092	72	64	·08
26	.595	526	·059	72	69	·03
27	587	530	·057	73	70	·03
28		690			79	
29	775	690	·085	80	79	·09
30	791	727	·064	80	80	·00
31	792	728	·064	82	76	.03

AUGUAST, 1850.

	Barometer.		Range.	Aneroid.		Range.
	Max.	Min.		Max.	Min.	
1	29·782	29·706	·076	29·84	29·80	·04
2	770	700	·070	82	80	·02
3	720	655	·065	80	76	·04
4		648			74	
5	712	632	·080	78	5	·03
6	733	636	·097	79	75	·04
7	760	666	·094	80	78	·02
8	742	642	·100	80	76	·04
9	768	661	·107	83	79	·04
10	779	685	·094	84	79	·05
11		704			80	
12	774	707	·067	84	80	·04
13	793	719	·074	84	81	·03
14	774	698	·076	83	80	·03
15	807	712	·095	86	81	·05
16	808	713	·095	86	81	·05
17	798	719	·079	86	80	·06
18		722			81	
19	826	715	·111	85	80	.05
20	758	668	·090	81	78	·03
21	756	666	·090	86	78	·08
22	807	701	·106	83	79	·04
23	845	737	·108	87	80	·07
24	806	718	·088	83	80	·03
25		650			76	
26	761	647	·114	81	78	·03
27	804	693	·111	83	79	·04
28	826	786	·040	84	81	·03
29	809	727	·082	84	80	·04
30	786	703	·083	83	79	·04
31	819	722	·097	85	80	·05

SEPTEMBER, 1850.

1	29·844	29·744	·100	29·86	29·81	·05
2		684			78	
3	778	674	·104	81	78	·03
4	837	710	·127	85	80	·05
5	868	760	·108	87	82	·05
6	855	760	·095	86	82	·04
7	777	662	·115	81	79	·02
8		633			79	
9	759	663	·096	85	79	·06
10	780	694	·086	86	81	·05
11	826	730	·096	89	82	·07
12	819	730	·089	90	83	·07
13	788	699	·089	87	82	·05
14	805	719	·086	87	81	·06
15		816			88	
16	931	811	·120	94	88	·06
17	871	811	·060	94	88	·06
18	824	728	·096	88	83	·05
19	822	730	·092	89	82	·07
20	871	764	·107	90	84	·06
21	871	772	·099	90	87	·03
22		735			82	
23	825	722	·103	89	82	·07
24	853	746	·107	90	85	·05
25	865	746	·119	91	86	·05
26	873	747	·126	91	86	·05
27	891	762	·129	91	88	·03
28	862	772	·120	92	88	·04
29		776			87	
30	891	777	·114	91	88	·03

OCTOBER, 1850.

1	29·891	29·763	·128	29 91	29·86	·05
2	891	777	·114	91	85	·06
3	856	731	·125	90	85	·05
4	860	740	·120	89	85	·04
5	889	772	·119	90	86	·04
6		767			86	
7	850	742	·118	90	84	·06
8	863	742	·121	90	82	·08
9	847	736	·111	88	80	·08
10	855	751	·104	87	80	·07
11	857	754	·103	88	80	·08
12	892	771	·121	90	84	·06
13		764			84	
14	847	712	·135	85	80	·05
15	840	708	·132	88	80	·08
16	773	662	·111	84	78	·06
17	771	667	·104	82	76	·06
18	824	696	·128	86	77	·09
19	874	751	·123	89	80	·09
20		755			80	
21	859	736	·129	88	80	·08
22	838	697	·141	88	79	·09
23	804	692	·112	84	78	·06
24	772	653	·119	81	77	·04
25	787	687	·100	83	75	·08
26	807	695	·112	82	79	·03
27		757			83	
28	855	727	·128	89	80	·09
29	862	752	·110	89	81	·08
30	874	779	·095	89	81	·08
31	913	804	·109	91	81	·10

	NOVEMBER, 1850.						DECEMBER, 1850.					
	Barometer.		Range.	Aneroid.		Range.	Barometer.		Range.	Aneroid.		Range.
	Max.	Min.		Max.	Min.		Max.	Min.		Max	Min.	
1	29·903	29·760	·143	29 90	26.80	·10	30·035	20·885	·150	29·81	29 80	·01
2	894	774	·120	88	83	·05		876			80	
3		785			80		29·939	821	·118	81	79	·02
4	908	770	·138	88	82	·06	947	853	·114	80	79	·01
5	877	751	·126	90	82	·08	30·001	908	·093	80	80	·00
6	897	764	·133	89	82	·07	013	891	·122	80	80	·00
7	938	817	·121	90	87	·03	29·996			80		
8	957	806	·151	91	88	·03		837			78	
9	933	766	·167	91	89	·02	998	860	·138	81	81	·00
10		738			82		30·000	876	·124	80	80	·00
11	836	697	·139	87	81	·06	028	900	·128	81	79	·02
12	800	664	·136	86	80	·06	29·998	878	·120	80	79	·01
13	860	738	·122	89	82	·07	30·009	896	·113	80	79	·01
14	952	820	·132	89	82	·07	048			82		
15	963	831	·132	93	89	·04		932			81	
16	971	831	·140	94	90	·04	069	934	·135	83	82	·01
17		871			91		067	931	·139	84	82	·02
18	996	842	·154	95	90	·05	025	912	·113	83	80	·03
19	982	839	·143	95	88	·07	046	932	·113	84	80	·04
20	975	864	·111	85	83	·02	064	923	·141	85	83	·02
21	30·037	920	·117	85	83	·02	058			85		
22	074	946	·128	85	83	·02		951			82	
23	051	897	·154	84	83	·01	061	924	·137	85	81	·04
24		908			81		021			84		
25	047	919	·128	83	80	·03		880			80	
26	050	898	·152	85	80	·05	018	914	·104	84	80	·04
27	008	893	·115	82	80	·02	003	889	·114	86	81	·05
28	034	891	·143	82	80	·02	041			85		
29	042	893	·149	82	80	·02		914			82	
30	026	891	·135	81	79	·02	051	917	·134	87	81	·06
							31	29·985	852	·133	84	80	·04

Professor Patton read a very interesting meteorological paper from Dr Ford, at Hoshungabad, for which we find ourselves unable to find room; as also an exceedingly able dissertation of his own on the theory of Woollaston and others on the pressure of different gases on each other. This also we must exclude.

The following resolutions were then proposed by the Hon'ble Mr. Willoughby, seconded by Mr Spens, and agreed to unanimously:—

1st.—That fifty copies of the barometric curves projected by Mr Mayes, as exhibiting the fluctuations of the collection of barometric instruments subjected by him to examination for twenty-four hours on end, be lithographed for distribution,—and that the figure tables, which formed the bases of the curves, be printed in the Society's Transactions and that copies of such of these papers as bore on his researches should be forwarded to Mr Piddington.

2nd.—That this meeting gladly avail themselves of this opportunity to record the high sense it entertains of the zealous exertions of Mr Mayes in reducing and preparing for publication the large masses of observations which have accumulated in the hands of the Society.

3rd.—That the Society return its best thanks to Dr Buist for the papers and explanations just laid before them.

4th.—That the Society return its best thanks to Professor Patton for the results afforded them of the very interesting researches now occupying his attention; and express their hopes that these may be prosecuted by him to a successful issue.

The following letters, papers, and donations, were then laid on the table:—

LETTERS.

From T. Waller, Esq., Deputy Medical Storekeeper, dated Belgaum, 31st ultimo, forwarding meteorological observations for the month of December last.

From Captain W. O'Brien, commanding Hill Rangers, Jaulna, dated 8th instant, requesting to be furnished with certain instruments out of the Society's supply.

From J. Connon, Esq., Secretary to the Chamber of Commerce, dated 7th instant, No. 8 of 1851, acknowledging the receipt of the Society's letter and its accompaniment, and forwarding the last seventeen reports of the Chamber, and intimating that the future reports will be supplied regularly.

From N. D'Oyly, Esq, dated 27th ultimo, requesting to be informed what it would cost him for a mountain barometer and a portable symplesometer, to enable him to remit the amount accordingly.

From G. V. Gungaram, Esq., dated Vizagapatam, 24th January 1851, forwarding his meteorological register for the month of December last, and requesting that the instruments ordered by him, be forwarded to him, and to his list and addition be made, that of a thermometer for boiling temperature, divided into $\frac{1}{10}$ of degrees.

From Lieutenant A. Aytoun, dated 27th ultimo, requesting to be furnished with one of the triple pocket lenses, and informing that the amount has been remitted through the Paymaster, 3rd Battalion of Artillery.

From Francis N. Maltby, Esq., dated Mangalore, 10th instant, requesting to be supplied with a mountain barometer, a thermometer, for boiling water at high altitudes, and a prismatic compass, and intimating that the weather reports will be supplied by Dr Foulis, as a pluviometer has lately been placed at his disposal for that purpose.

PAPERS.

Observations from Surat, Hydrabad, Rajcote, Shikarpoor, Kurrachee, Sawant Warree, Pahlunpoor, for the months of October, November, and December, 1850.

From Larkhana, for September, October, and November.

From Ports of Cuddalore, and Coconada, stations of Guntoor, Chittoor, and Cuddalore, St. Thomas's Mount, Civil Dispensary Nellore, and Vizagapatam, for December.

From the Zillahs of Calicut and Mangalore, Garrison of Cannanore, and stations of Secunderabad and Kurnool, for November 1850.

From Belgaum, for the whole of the year 1850.

BOOKS.

The Journal of the Indian Archipelago, for the month of September, October, November and December 1850. Presented by Government.

Mr MacKay's Travels in the United States in 1846-47. 3 vols. Presented by Mr Cormack.

Report of the Bombay Chamber of Commerce, 17 Nos. Presented by the Chamber.

The Bombay Times' Calendar and Almanac.

Notice of motion for next meeting.—Proposed by Mr Willoughby, second by Mr Spens:—

"That A. Mackay, Esq., be elected an Honorary Member of this Society."

THE Bombay Geographical Society held its ordinary monthly meeting on Thursday the 20th March 1851—the Honorable J. P. Willoughby, Esquire, in the chair. Present: Commodore S. Lushington, R. N.; Major G. LeGrand Jacob; Commander G. Jenkins, I. N.; John

Ritchie, Esquire; John Smith, Esquire; Venayekrao Jagonnathjee, Esquire; Professor J. Patton, and Dr. G. Buist, Secretaries.

The minutes of last meeting were read and approved of.—The following report from the Committee on Charts was read, and, with the exception of the third clause, which was slightly altered to the shape in which it now stands, approved of:—

REPORT TO THE PRESIDENT AND MEMBERS OF THE GEOGRAPHICAL SOCIETY, OF THE COMMITTEE ON CHARTS APPOINTED 23RD JANUARY.

Your Committee having maturely considered the whole question committed to them, and availed themselves of all the information on the subject of Wind and Current Charts within their reach, resolved,—

1st.—That it would be eminently desirable, before the Manuscript Charts submitted to them were sent to press, that they should be made as perfect as possible on the same general plan as that on which they have been constructed: and that as many additional tracks as could be procured without any undue amount of delay should be projected on them.

2nd.—That the best mode of doing this appeared to be to prepare and print lists of queries, to be distributed amongst Commanders of Merchant Vessels, and others likely to contribute such information as might be desired, with Schedules, to be filled up and returned by them to the Society, from which further tracks might be laid down on the Charts.

3rd.—That the Committee, having no funds at their disposal, shall be allowed to draw on the ordinary funds of the Society,—replacing this, if deemed desirable, from the funds provided for the publication of the Charts, should they come to be published.

(Signed) S. Lushington; J. C. Hawkins; J. Smith; John Ritchie; Geo. Buist; Joseph Patton.

Bombay, 19th March, 1851.

The following resolutions were then brought forward, and unanimously agreed to:—

"1.—That Government be applied to for permission to bestow the balance, should any remain, of the Rs. 3000 granted by them in 1848 for the publication of the Meteorological and Tidal Observations made under the auspices of the Society, to that of the Observations forwarded to the Society by the Bombay, Madras, and Bengal Governments,—all of them bearing on the same general subject.

"2.—That Government be applied to to meet the charges of setting up and putting to work at Poona, Mahabuleshwar, Ahmednuggur, or such other situations as might seem desirable, the Wind-Gauges just returned from Aden, where they were no longer required, and that received from the Observatory, formerly in the possession of the Madras Government,—these being public property."

In reference to the first, it was explained that the form in which the Tidal Observations were proposed to be published, differed so materially from that on which the estimate was prepared when Government were applied to for the grant promised them, that on this alone above Rs. 1000 would be saved; that the Bombay Tidal observations, then expected to fall on the grant, had been published in the Observatory Report; while the Kurrachee, Porebunder and Vingorla Observations required yet to be made. The Bombay Government had meanwhile furnished the Society with a very valuable collection of Observations, and a large collection had been received from Madras and Bengal; and in proposing that the Government grant be employed in the publication of these, all that was asked was that an unabsorbed balance should be transferred, from one division of a general scheme to another.

The instruments referred to were all the property of Government, and the Society were prepared to see to the use made of them, and to the publication of the observations—but their funds did not allow of more. An altitude and azimuth circle belonging to the Observatory with

which Mr Mayes had been provided by Mr Orlebar on proceeding to Aden, was exhibited: it was the fellow of the instrument described in the report for 1846 as having been employed at Surat, in Salsette, and on the Mahabuleshwar Hills, and for the use of which the Society had applied, when it was asserted that it never had existed. The magnetic portion of that now on the table was in the Observatory, where, of course, it was useless for magnetical purposes, without the portion Mr Mayes had at Aden: he had frequently applied for it, but received no answer.

A large collection of observations on the occultations of Jupiter's Satellites, by Mr Mayes, was laid on the table: they had been taken with the view of determining with precision the longitude of the observatory on Seerah Island. A fine Achromatic Telescope, with a Transit instrument, belonging to Mr Mayes, were laid on the table; as also a Hansteen's magnetic apparatus he had just had constructed for himself in the bazaar.

The Secretary stated that the Society had at last meeting recorded a vote of thanks to Mr Mayes for his exertions: the instruments now on the table had since then been received from Aden, and he had considered it expedient to place them before the Society to show, not only the exertions made by a man lately a private soldier, and who was entirely self-educated, but who had pursued so severe a system of economy as to make large savings from his narrow income, and bestowed these on objects so different from those usually sought after in India—on scientific instruments, the value of which he had learnt through his own industry, and which he had shown himself so competent to use for the advancement of science. Labours of this sort, pursued in the face of so many disadvantages, were peculiarly deserving of notice and commendation, and implied a degree of merit men pursuing a similar course under circumstances more favorable could not lay claim to.

The Chairman fully concurred in the praise bestowed on Mr. Mayes, and considered that the exhibition of the instruments now before them, along with the observations which were laid on the table, in addition to what the Society already knew of the exertions of Mr Mayes, warranted the Society in conferring on him some more substantial mark of the estimation in which his exertions were held by them than a mere record of their approval.

Notice was then given by the Hon'ble Mr Willoughby, seconded by Major Le Grand Jacob, of the following motion for next meeting:—

"That with reference to the papers and the instruments produced before the Meeting obtained by his own resources, and to mark the high sense which the Society entertain of his meritorious and valuable services in promoting the objects of the Society, a Chronometer of the value not exceeding £50, with a suitable inscription, be presented to Mr. Mayes."

Some conversation then ensued on the subject of a letter addressed by Commander Jenkins to the Secretary on the subject of a paper which had been sent round with the circulars to the Committee on Current Charts: the document in question appeared to have been sent round by accident, without the knowledge of the Secretary.

The letter of Commander Jenkins, which had been desired to be laid before the Society, had been sent round to the Committee on Charts for consideration, and had not been returned to the Secretary. He regretted its disappearance, but could give no explanation regarding it: he had no doubt whatever that it would cast up. He had placed it in the hands of sepoys, and expected to have found it amongst the papers on the table of the Society.*

* The letter and its accompaniments have since been found in a drawer where, they had been placed by the sepoy in the evening for security, until they should be taken round on Monday, when they were forgotten

Various letters and papers were then laid on the table :—

LETTERS.

From Captain E. Whichelo, Deputy Commissary General, requesting the Society to take charge of the boxes of Meteorological Instruments consigned to them, arrived from "Aden" per H. Co.'s Steamer *Moosafer*.

From the Acting Secretary Military Board, No. 1531, dated 25th ultimo, acknowledging the receipt of the Society's letter No. 10, dated 19th February, and stating that they have no authority to incur any expenditure in carrying out the measures proposed by the Society.

From Messrs Smith, Elder, and Co., London, dated 19th January 1851, informing of their having forwarded a small package to the Society per that day's steamer, containing a copy of Thomson's Introduction to Meteorology.

From Cursetjee Jamsetjee, Esq., dated 15th instant, acknowledging the receipt of the Societys letter, No. 11, dated 21st ultimo, informing him of his having been elected a member.

From Manockjee Nasserwanjee & Co., dated 18th Instant, requesting a Pocket Compass and a Magnifier, required by Captain Hebbert, Engineers.

PAPERS ON METEOROLOGICAL OBSERVATIONS.

From Calcutta, Vizagapatam, Sattara, and Ports of Cuddalore and Coconda, for January 1851.

From Kolapore, Bushire, and Garrison Hospital Trichinopoly, for October, November, and December, 1850.

From Calcutta, stations of Bangalore, Hurryhur, French Rocks, Kamptee, Zillahs Mangalore, Calicut, Coimbatoor, and Garrison of Cannanore, for December 1850.

BOOKS.

Sketch of Mairwara, by Lieutenant Colonel C. J. Dixon.—Presented by Government.

Report of the Geological Survey of India, for the season of 1848-49, by J. M'Clelland, F. L. S. G. S. L. S.—Presented by Government.

Journal of the Asiatic Society of Bengal, No. VI, 1850.—Presented by the Society.

Mr A. Mackay, the Manchester Cotton Commissioner, was unanimously elected an Honorary Member of the Society,—having been duly proposed by the Hon'ble J. P. Willoughby, Esq., and seconded by A. Spens, Esq.

At a Monthly Meeting of the Bombay Geographical Society, held on the 24th April, 1851. Present: Colonel George Moore, Senior Member present, in the Chair; W. E. Frere, Esq.; Captain P. T. French; Captain H. J. Barr; Commander G. Jenkins, Indian Navy; John Ritchie, Esq.; Dr B. White; Major LeGrand Jacob; Norman Oliver, Esq.; Venaikrow Jugonnathjee, Esq.; Dr George Buist, L. L. D., and Professor Joseph Patton, A. M., Joint Secretaries.

The minutes of last meeting having been read and approved of, the following motion, proposed last Meeting, was put from the Chair, and agreed to unanimously :—

Proposed by the Honorable Mr. Willoughby, and seconded by Major LeGrand Jacob,—That, with reference to the papers and the Instruments produced before the Meeting, obtained by his own resources, and to mark the high sense which the Society entertain of his meritorious and valuable services in promoting the objects of the Society, a Chronometer, of the value not exceeding £ 50, with a suitable inscription, be presented to Mr. Mayes.

Dr Buist was instructed to place himself in communication with Commodore Lushington, who had kindly undertaken to assist in the matter, and to have the

views of the Society, as formerly expressed, carried into effect, in the manner likely to be most acceptable to Mr Mayes.

The following Report from the Committee on the Ross Testimonial was then read by the Secretary :—

REPORT of the Committee on the Ross Testimonial, appointed on the 22nd July 1849, for the purpose of carrying out the Resolution of the Society, that a Portrait of Captain Ross be procured by subscription, to be hung up in the Rooms of the Society.

1st. On the 16th August 1849, your Committee reported that they had proceeded to receive subscriptions to the Ross Testimonial, and that the sums then set down amounted to Rupees 1564; that, after setting aside an amount sufficient for procuring a Portrait, a large balance would remain to be expended according as the Society should determine. At this date the Society, in accordance with the recommendation of the Committee, rescinded the resolution as to the maximum amount to be subscribed, and threw the list open to the general public. The family of Captain Ross, having been referred to, expressed their gratification at the proceedings of the Society, and their anxiety to assist in carrying out their views.

2nd. In March 1850, the Peninsular and Oriental Steam Navigation Company forwarded the munificent sum of £105 as their contribution to the Ross Testimonial Fund, and up to the present date Rupees 3,014 have been set down, of which Rupees 2,703 have been realized.

3rd. On the 16th May 1850, the Society directed the sum of £200 to be remitted to Captain Beecher, for the purpose of defraying the charges of fitting up certain maps and charts, which were to be hung up in the Rooms of the Society, as a portion of the Testimonial. That officer has since intimated that the sum forwarded greatly exceeds the exigencies of the occasion, and that the charges incurred by him in forwarding the views of the Society will be comparatively small. A large balance remains in his hands, the amount of which he has been requested to intimate to the Society, when its disposal may be determined upon. To this letter, which was dispatched on the 3rd of October, no answer has up to the present time been received.

4. At the date just referred to, £50 was remitted to Colonel Lloyd, by direction of the Society, to meet the charges of the Portrait of Captain Ross, Colonel Lloyd having carried into effect the wishes of the Society, the Portrait having been dispatched by the Ship *Sutledge*, which sailed on the 4th December.

6. The Committee have prepared for the consideration of the Society a draft of a letter in reply, and now report the task assigned to them at the date of their election completed, and beg to place at the disposal of the Society the various circulars, minutes and other papers, containing a record of the details of their proceedings.

(Signed) J. P. WILLOUGHBY; J. C. HAWKINS; G. JENKINS; G. BUIST, Secretary.

It was moved by Colonel Moore, seconded by Major LeGrand Jacob, and unanimously agreed to,—"That the Committee, on now being dissolved, receive the cordial thanks of the Society, for their exertions in carrying into effect the objects for which they were appointed."

A letter from Government, under the Military and Marine Departments, in reply to that of the Secretary, of date 21st March, was read, sanctioning the extension of the grant of rupees 3,000 to the publication of such observations as the Society deemed proper, beyond those originally specified, and leaving the arrangement of this entirely in the hands of the Society. In reference to the portion of the Society's letter referring to the erection of Self-registering Wind

and Rain Gauges, one of which had been received direct from Government, and two others having been returned from Aden, Government desired to be informed of the charges likely to be incurred by their erection at Poona, Mahabuleshwar, Nuggur, or other stations, and the results that were contemplated from their employment. It was stated in reference to this, that the instruments were much more complex, cumbrous, and expensive, than any contemplated by the Society at the time the scheme of meteorological research was projected; but as they had been sent out by the Court of Directors, on the recommendation doubtless of some high scientific authority, it would seem strange to permit them to remain useless in store,—still more so to return them to Europe. The Society had resolved to address Government on the subject, the instruments having been committed to their charge, and they recommended Mahabuleshwar, Poona, and Nuggur, for their use, as stations widely separated from each other, and as possessed of a great diversity of climates; and as points at which it would be matter of very great interest to ascertain the relative forces and directions of the winds, and the relative amount of rain at each. Though it might not have been considered essential for such ends to provide new instruments, such as those now in possession of Government, it would be well worth while, as they existed, to have them set up, especially as at all the three places recommended facilities for doing so existed which would render the experiment inexpensive.

The best mode of dealing with the matter seemed to be to refer to the Military Board for estimates, explaining to them that the instruments were the same as those at the Observatory, Colaba,—that two of them had been used for years on the roof of a couple of cadjanned huts at Aden, and that the roofs of the barracks at Poona, Nuggur, or the Sanitarium at Malcolm Peth, would afford every convenience that was desired.

The following extract of a letter from Captain Hazlewood, with a minute from the President, was then read :—

Extract of a letter from Captain Hazlewood, commanding Rutnagherry Rangers, dated the 23d February 1850, describing some Hot Springs in the Southern Konkan.

"We were at Arowlee yesterday, where there is a very beautiful hot spring. The Brahmins are in the habit of bathing and washing their clothes in it; and, finding it in a very filthy state, we put a dozen men into it, and emptied and thoroughly cleansed it. It filled again in the course of two hours, and the water was then as pure as crystal. I plunged a thermometer into it, and it rose to 105°, after being in a few minutes. The water of this spring is strongly impregnated with sulphur.

"We bathed in it, and enjoyed our bath amazingly. There is a *very hot* spring, which is passed coming up the Dhabool Karee, at Monje Oonaren Turuf, Haweylee, Jafferabad, in the Sooverndroog talooka. Distant about 400 paces from the Karee, on the left side as you come up, it is so hot that rice is boiled in it in a few minutes. Oonaren is two miles from the mouth of the Dhabool Karee. There are two others at Golowlee and Rajwaree villages, between Arolee and Lungnushwur; but they are so hot that you cannot put your hand in, without being scalded. There is another, of the same temperature as the one at Arowlee, close to Lungnushwur, in the middle of the river. I hear also of another in the Sooverndroog talooka, at Oonowren Turuf Natoo Palwan, not so warm as the one we tried yesterday. There is also a hot spring at Rajapoor, which issues out of the mouth of a stone cow, and falls into a small tank. This is of the same temperature as the Arowlee one, and much bathed in by the natives. I can hear of none in the Malwa talooka.

MINUTE BY THE PRESIDENT.—I have the pleasure to submit to the Society, an extract from a letter from Captain Hazlewood, commanding the Rutnagherry Rangers, addressed to H. B. Frere, Esq., late Commissioner at Sattara, describing some hot springs in the Southern Concan.

This subject is one of considerable interest in a Geographical and Geological point of view, and is one which I would recommend to the attention of the Society.

I doubt if any complete account of these springs exists :—a description, to be of any value, should be very complete, so as to omit none—and very accurate and minute as to situation, temperature, &c. &c.

If no description of this kind exists, (and our Secretary will be able to answer the question), I think the Society might rely on Captain Hazlewood's assistance, to do what is required.

Perhaps the best plan would be for the Secretary to send this officer a tabular form, to fill up, and to ask him to send a little rough sketch map of each locality, so as to show the *exact* position of each spring, with reference to villages, &c. The zilla maps of the two Concans would assist in preparing these.

Major T. Jervis' account of his survey of the South Concan may perhaps contain some information respecting these springs.

If my suggestion is considered worthy of adoption, in communicating with Captain Hazlewood on the subject, the thanks of the Society should be conveyed to him for the interesting information contained in his letter of the 23rd February, 1850.

22nd April, 1851. J. P. WILLOUGHBY.

The Secretry (Dr Buist) stated that we already possessed a considerable quantity of information in reference to the hot springs of India: it would be in the last degree desirable to have it encreased in amount, and made more precise and exact in quality; and no better plan for doing so could be adopted than that pointed out by the President. Officers on out-post duty, and more especially when in charge of irregular troops, could, with very little trouble to themselves, on many occasions perform the most important services to science. Sir R. Impey Murchison had called the attention of the Governor and Commanderin-Chief of India to the achievements in this way of Captain Vicary, of the Bengal service, who had traced the marches made by him in course of military duty by a list of most valuable papers on various branches of natural history. Captain Newbold, Dr Malcolmson, and others, had also earned imperishable names for themselves by similar service. Much scientific knowledge is not at all an indispensable qualification in the observer: careful and diligent enquiry, and keen and unceasing observation, could of themselves accomplish wonders. The temperature of some hot springs was believed to fluctuate with the different seasons of the year; that of others was supposed to increase or decrease in the course of a term of years; and a precise determination of the fact would be most desirable. The hot springs near the shores of the Red Sea are sulphureous :* they are probably connected with the great volcanic belt of which Aden, Gibbel Teir, and the Zeybar Islands, furnish the most notable manifestations. The springs of El-kaor in the oasis of Dakkleh, are the hottest known in this neighbourhood,—they reach a temperature of 102°; Moses' Wells, near Tor, in the Sinai

* Captain Newbold on the temperature of Intertropical Springs and Rivers.—London Philosophical Transactions and Edinburgh new Philosophical Journal, 1846, p. 102.

Peninsula, are 90°; the hot baths of Pharoah, about ninety miles to the northward of Tor, are said to be still warmer than this.

The hot springs of Jumnotri, in Northern India, Lat. 30° 52′, reach a temperature of 194° at the altitude of 10,849 feet, or close upon the temperature at which water boils at this elevation. They are believed by Newbold to be the hottest known to us. Hot springs are spoken of by Burnes in the direction of the Salt Range on the Indus. Dr Voysey describes a hot spring of unusual beauty near Maulmain, the temperature of which is 136° or 12° hotter than the waters of Bath.* Mr Hardy mentions one at Chitoor,—it seems to be a Harrowgate, but is very slightly hot.† Gerrard describes several in Kunawur.‡ and Captain (Sir C. Martin) Wade gives an account of three near Lohumkurd, on the Sutlej.§ There is a hot spring in the Halla mountains, which discharges huge quantities of calcareous tuffa,‖ and some of much interest in the Lukkee Range.¶ By far the most celebrated hot springs in Scinde are those of Mugger Peer, ten miles from Kurrachee, of which numberless descriptions have been given, none surpassing in minuteness and excellence that of Captain Carless, who first described them, and whose paper appears in the second volume of our Transactions. It is more familiarly known to the world as the Crocodile Tank. In an early number of the Bombay Medical and Physical Transactions, an interesting account is given by Dr Gibbson of the hot springs in Goozerat —that of Oonee being believed to grow suddenly colder in the month of April. Colonel Sykes quotes the account given by Colonel Briggs of two curious hot springs in the Sapoora Range, called Oonoop Dieu and Soonoop Dieu. Tatta Pari, in the Saryuyu districts, Central India, is described by Colonel Ouseley as attaining a temperature of 184.° The following list of the hot springs in the Konkun is given by Dr A. Duncan, in the Bombay Medical and Physical Transactions, and quoted in the London Philosophical Transactions by Captain Newbold. The quotation is given in the words of the writer:—

Note on the Thermal Springs of the Peninsula of India.—Since my arrival here, my friend Mr. Malcolmson has put into my hands the first volume of the Bombay Medical and Physical Transactions, where I find, p. 257, a few notes on the thermal springs in the Konkan, by A. Duncan, Esq. The geographical distribution of these springs corroborates the remark in my paper, under the head of thermal springs, viz., "That the majority of the springs termed thermal occur in India at or near lines of great faults." The thermal springs, mentioned by Mr. Duncan, lie at the base of the Western Ghaut elevation, intermediate between the mountains and the sea, generally from 16 to 24 miles, or thereabout, inland from the latter. The line of springs follows pretty nearly that of the mountains, viz., nearly north and south; and extends from the vicinity of Surat, or about 21° N. lat. to South Rajapore. They are supposed to exist still further south, following, at irregular intervals the line of West Ghauts to Ceylon. Not less than twelve are known to exist between Dasgaun and South Rajpore, viz.—

1 at Oonale, in the taluk of Viziadroog.
3 in the Rutnaghirry taluk, at Rajwaree, Tooril, and Sungmairy.
1 at Arowlee, in the Konedree taluk.
1 at Mat, Hatkmubee Mahal.
1 at Oonale, in the Natoe Palivan Mahal, Severndroog.
3 at Oonale Jaffrabad Maahl.
1 at Savi, in the Ryghur taluk, Bhar Nergannah.
1 at Oonale, Sankse taluk, Mahal Palee.

12 total.

* Asiatic Researches, 4to. edition, vol. XVIII., part I., p. 154.
† Ibid. part II., p. 53.
‡ Account of Kunawur, London, 8vo., 1841.
§ Bengal Asiatic Transactions, vol. VI., p. 155.
‖ Geological Transactions of London, 8vo. edition, vol. I.
¶ *Bombay Times*, March 1845.

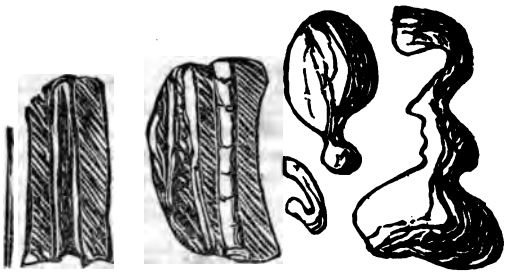
Oonale is the native term for a hot spring. The temperature of all the springs examined exceeded, with a single exception, 100° Fahr., and amounted to 109°. That of Tooril, which, unfortunately, was not thermometrically ascertained, appeared to Mr. Duncan to be almost at the boiling point. The water was not found to be mineral, though impregnated with sulphuretted hydrogen. A little higher up, in the hill where the thermal spring, No. 1, occurs, is a singular intermittent cold spring, over which a temple has been built. It is resorted to by crowds of Hindoos, during the season when the fountain periodically flows, viz., during the hot months. A more minute analysis of the water, and a more continued series of thermometric observations, are a great desideratum.

The temperature of a hot spring at Oonye, in the jungle between Bansda and Boharee, is asserted by the Brahmins to diminish annually at the time of the full moon in April, so as to admit of persons bathing in it at this period, when the natives assemble there in great numbers for that purpose. The assertion was contradicted by the late Dr. White; but the question, I see, has again been raised by the observations of Mr. J. S. Law, of the Civil Service, who found the temperature of the hottest part of the spring to have diminished, at this period, from 124° to 94° Fahr. It is probable, however, that future observations on this supposed singular annual variation will set the matter at rest. *Captain* NEWBOLD *on the Temperature of the Intertropical Springs and Rivers.—Edinburgh New Philosopical Transactions, p.p.* 114-115.

The information then wanted was—1st,—The temperature of the springs by day and by night, at every season of the year. 2nd,—The discharge when procurable—this being most readily obtainable by baling out the water from them with a vessel of known capacity, so as just to keep them below a fixed point, which might be marked by laying a bamboo across them, making a mark in the rock or bank, or by any other contrivance,—noting by a watch the number of measures discharged in a given time; a second method was to lead away the water from the spring in any sort of spout that was most easily come by, into a vessel serving as a measure; the third to dig a hole, and have the rivulet from the spring discharged into it, and keep emptying this down to a mark, as before recommended for the spring itself. A little practice in this way soon accustomed the eye to guess within a trifle of the discharge of any fountain or stream. 3rd,—The character of the rock from which the fountain issued, and of the rocks around. Where the observers were not geologists, good clean specimens, about the size of the hand, would be desirable. Should the observer desire to make a collection for himself, he might keep duplicates, numbered in the same way as those transmitted, when a list of the names belonging to the numbers would be returned. A sketch of the country, with a note of the place of the spring on the map, was also most desirable. And finally, specimens of the water should accompany the description.

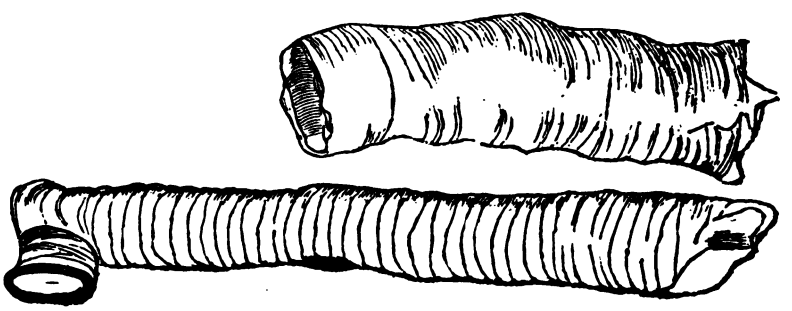
Dr Buist then laid the following specimens on the table from excavations now in progress:—From the railway cuttings on the Flats—kunkur, kunkur tubes found in mineralised mangrove roots, selenite, and masses of oyster shells. From the Town Drain near the theatre—masses of oyster shells, kunkur, and shell-gravel. From the Dhobie Tank—littoral concrete, cemented by calcareous spar, by which minerals the shells were filled up. From the well on the glacis betwixt the Apollo and Church Gates—concrete, gravel and shells, and large masses of coral unaltered. The present was a peculiarly fortunate season for geological enquiries at Bombay, from the large number of excavations now in progress; the extreme nicety with which the levels of the Railway and Town Drain had been determined saved the geologist in this way a large amount of survey work. The section of the railway showed very clearly the relative positions of the blue and yellow clays—the former being invariably above the latter, which seemed in most cases to be the result of the decomposition of the rocks underneath, and for the most part abounded with fragments of these: when it extended to the surface, it was filled with yellowish brown coloured kunkur, such as was found in the interior. The blue clay becomes brown and friable on exposure to the air

and the change is hastened by cultivation: it is distinguishable at the surface, from the numberless rents, cracks and fissures with which it is traversed. It abounds with a totally different species of kunkur from that found in the yellow clay—of a greyish blue colour, assuming the most fantastic forms, and almost always attaching itself to some piece of wood, straw, or other vegetable nucleus. It made an excellent water cement when burnt, powdered, and sifted, settling in the course of three or four minutes.



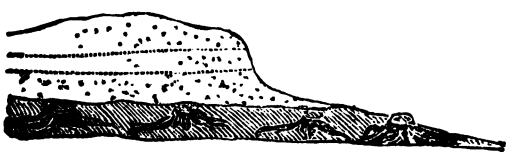
Kunkur found in the blue clay beds of the Flats, which extend under the shell-gravel and concrete of Mahim Wood, Sewree, the Esplanade, &c.

It has been collected along the line of the embankment as ballasting for the railway. Specimens of the tubes had been formerly laid before the Society: they consisted of a series of coatings of calcareous spar—they seemed to be encrustations in perforations made by some species of worm or borer in the rotten mangrove roots with which the blue clay everywhere abounded. The roots themselves were occasionably to be met with tolerably entire in the line of the railway, but were not very plentiful: the prevalence of the tubes, which were to be found over nearly all the lower portions of the island, unless where shell-gravel, loose or indurated, prevailed, seemed proof sufficient of mangrove roots having existed, though now disseminated in our soil and lost.



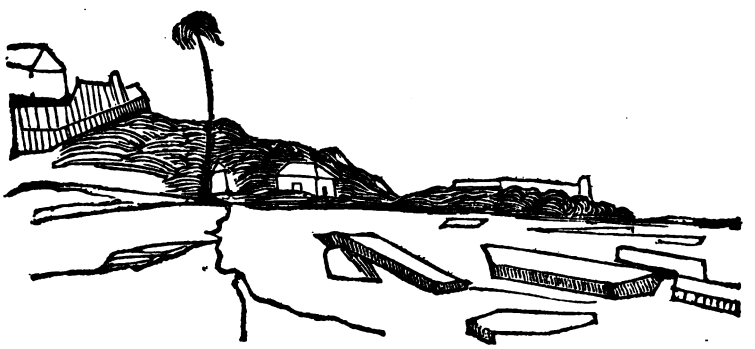
Tubes found in the perforations of the rotton mangrove roots embedded in the blue clay formation. No perforations or tubes such as these have ever been met in with in the roots of recent mangroves, however much decayed. They are supposed to arise from the infiltration of water charged with lime, such as generally prevails everywhere during the monsoon. The tubes vary from a quarter to three quarters of an inch in diameter—they are often a a couple of feet in length, though they can rarely be taken out more than six or eight inches in one piece. The walls of them vary from a few lines to a tenth of an inch in thickness. They are generally crystallised in layers, of which there are from twenty to thirty discernible under a magnifier: they are of a pinkish white colour externally.

The oyster shells were found in masses on various parts of the line : the place most worthy of remark was opposite Matoonga, where the oysters were some feet above highwater mark. The selenite was found in thin plates and lenticular formed pieces, seldom the size of the hand—their cleavage was always at right angles to the walls of the crack or vein in which they were found, and parallel with the edge of the plate. The reverse was the case with the selenite found in Egypt and in Scinde; in nearly the whole of these the plate split in the direction of its plane, that is of the walls of the crack or vein containing it. The selenite of the flats was earthy and opaque outside—internally it was pure, splendid, and perfectly transparent; it split up like talc. There seemed every reason to suppose that wherever the soil contained sea salt and corbonate of lime, here selenite or gypsum might be observed. The kunkur from the Town Drain was like that from the flats, only highly ferruginous and poor in lime: the forms of the nodules were still more fantastic. On the south side of the Grant Road, near the Theatre, the shell beds first began to show themselves: here the shells were loose. The same arrangement presented itself where the Grant Road terminated, opposite the gate of Juggonath Sunkersett's mansion house. Vast masses of oyster shells were found some four feet under the surface, in the blue clay—this was probably some way under the present high water level. Tubes also prevailed here, though there were no mangrove roots. The mangrove roots, when first turned up, were soft and pulpy—a few months' exposure to the air rendered them hard and friable, like lignite, or coral. The Esplanade specimens were the most singular of all. The concrete from the Dhobie Tank was from twenty-five to thirty feet below the surface : here it was extremely compact, and the cementing matter highly crystallised. The texture of thick walled shells, such as the Pirena terebralis, of Sowerby, was in many cases already gone, —the outer and inner coating, and general aspect of the shell, was unaltered : when broken, it was entirely transformed into beautifully crystallised calcareous spar. Almost the whole of the shells were filled up with this, —in others the outer coat of the shell was perfect, while the whole interior was one mass of crystals. In many cases, again, in specimens close beside these, thus altered, the shell was unchanged. It was chiefly beside the Marine Lines, and again near the Church Gate, that these very compact varieties of concrete were found. In a well dug last year opposite the Elphinstone College, the blue clay with mangrove roots was met in with about ten feet down—the bed usually under such circumstances emitting a sulphureous smell. In the Eastern part of the Esplanade, the clay bed seemed awanting, and here in general the shells and gravel are loose and uncemented.



Sections of the shore near Sewree.

At twelve feet the trap was reached, and here it was coated over with large masses of coral, such as that presently found alive in Back Bay. Water here gushed in through the quicksand just over the rock from all sides in great rushes of ten or twenty gallons a minute. The condition of the coral was worthy of special notice: instead of being filled up with spar like the shells themselves near the surface, the fine limes and tubes were as clear, perfect, and delicately preserved, as if the zoophite had just quitted them. What was still more singular was this—that whereas all the upper shells were rounded and much water worn, the coral had hardly suffered from attrition—but looked as if it had been suddenly submerged and covered over while alive by a gravel bank, never since then disturbed from over it. The coral itself as now existing in Back Bay became detached from the rock, and tumbled about with the surge so soon as the zoophite died, and was first rounded, and soon after ground to powder by the breakers,—that under the Esplanade continued firmly adhering to the rock. It was most singular that the water pervading these beds should within such short distances perform such different effects, in the one case leaving the shell gravel loose, and the coral unaffected, in the other cementing or sealing up with calcareous spar everything that came in its way. It would be curious to know whether the presence or absence of the blue clay with its mangrove roots had any relation to states of matters so opposite to each other.



Broken masses of concrete on the beach near Sewree Fort—the blue clay has here been washed out by the surge—great masses of concrete rest on the trap.

In the well to the westward of the Church Gate, fragments of pottery are found four feet under the surface: though the ground has no appearance of having been disturbed here, circumstances are not sufficient to warrant the assumption that they afford a positive proof of the age of the littoral concrete—they *may* have come into their present place after its upheaval,—the fact of their appearance is at the same time worthy of note.

It is of the utmost importance, especially during a season so favorable as the present for such researches, that the most careful drawings and measurements be made, and descriptions retained, of all the sections the excavations present us. These matters are now everywhere else subjects of regular record and it is of the greatest consequence that they should be so. The complaint of Captain Newbold that he could not find a single record in any office or repository in Bombay of the excavations or diggings that had been going on amongst us for a century at least, was as grievous a reflection as well could be imagined on those affected by it.

The following donations and letters were then laid before the Society:—

LETTERS.

From Smith, Elder & Co., London, dated 24th February, informing of their having forwarded per that day's steamer a package containing the Pocket-Magnets, and a new volume of the Hakluyt Society.

From T. Holcroft, Esq., dated 20th March, begging to withdraw his name from the list of subscribers to the Society.

From Captain E. Whichelo, Deputy Commissary General, dated 11th instant, requesting to be informed whether the Society can supply, for the use of the Medical Stores, 10 Pans, round block tin, Evaporating, and the rate of each.

From Lieutenant H. G. Raverty, enclosing a draft on Messrs Forbes & Co., for Rupees 15, on account of his subscription for this year.

From J. G. Lumsden, Esq., Secretary to Government, Marine Department, No. 313, dated 9th instant, acknowledging the receipt of the Society's letter No. 21, dated 27th March.

From E. Roberts, Esq., Surat, dated 11th instant, requesting to be furnished with a pamphlet giving a description of the instruments, and the method of adjusting them in case of their getting out of order.

From J. G. Lumsden, Esq., Secretary to Government, General Department, requesting the Society's acceptance of a Report of the Proceedings of the Department of Public Works for the year 1848-49.

From Surgeon Wiehe, Sattara, dated 17th instant, acknowledging the Society's letter No. 24 of 1851, and informing that the instruments he had applied for in May 1850 are not now required.

PAPERS ON METEOROLOGICAL OBSERVATIONS.

From Stations of Kamptee, Chittoor, Cuddalore, Guntoor, Bellary, Kurnool, Mercara, Hurryhur, French Rocks, Bangalore, Zillah Mangalore, Calicut, and Kuddapah, Pallunkot, Cantonment of St. Thomas' Mount, Civil Dispensary Nellore, Garrison Hospital Trichinopoly, and Garrison of Cannanore, for the months of January and February 1851.

From Stations of Vizagapatam, Masulipatam, and Rajamundry, for October and Nov. 1850.

From Ports of Cuddalore, and Coconada, Sattara, and Penang, for February.

From Stations of Secunderabad, Iavoy, and Coimbatoor, for January 1851.

BOOKS.

The Cotton and Commerce of India, by John Chapman. Presented by G. Bulst, Esq., L. L. D.

Observations on Days of Unusual Magnetic Disturbance. By Lieutenant Colonel E. Sabine. Presented by Government.

Divers Voyages touching the Discovery of America and the Islands adjacent, by Richard Hakluyt. Presented by the Hakluyt Society.

Journals of the Asiatic Society of Bengal for June, July, August, and September 1849, and Nos. I, II, III, and IV of 1850. Presented by the Asiatic Society of Bengal.

The Bombay Engineers' Report for the official year 1848-49. Presented by Government.

Reasons for returning the Gold Medal of the Geographical Society of France, by C. T., Beke. Presented by the Author.

A considerable amount of private business was then despatched, the details of which do not require to be reported at length.

The Members were reminded that the next was the Annual Meeting, when Office-Bearers required to be elected,—when it was probable that the Presidentship of the Society would require to be filled up, and a vacancy would in all likelihood occur amongst the Vice-Presidents.

MEETING OF THE GEOGRAPHICAL SOCIETY.

At the Annual General Meeting of the Bombay Geographical Society held in its Rooms, Town Hall, on the 22nd May 1851—

Colonel George Moore, *President*—in the Chair.

Present:— Capt. P. T. French; W. E. Frere, Esq.; Capt. H. J. Barr; T. L. Jenkins, Esq.; Venaikrow Jagonnath, Esq.; Dhunjeebhoy Framjee, Esq.; Norman Oliver, Esq.; Juggonath Sunkersett, Esq.; Cursetjee Jamsetjee, Esq.; Manockjee Cursetjee, Esq. and Dr. Buist, LL.D., Joint Secretary.

On taking the Chair, Colonel Moore said—"It has been the general custom of this Society, on the removal by death of any of the more distinguished of its members, that the matter was adverted to from the Chair before the Minutes were read.

Moved by the Chairman, seconded by Dr. Buist:—

"That before proceeding with the business of the day, the Society record its deep sense of regret at the demise of Captain S. V. W. Hart, one of the oldest Members of the Society, and one of the most valued of the early contributors to its Transactions."—Unanimously agreed to.

The minutes of last Meeting, and of the Special Meeting of the 26th ult., having been read, the Secretary stated that the Committee appointed at the General Meeting to prepare an Address for the Honorable Mr Willoughby having found their nomination irregular, Rule XIX, requiring previous notice of all motions to be given, not having been complied with, minuted the circumstance, and desired it to be reported at the special meeting then requested to be summoned on the receipt of the resignation of the President not before the Society at the time of Ordinary Monthly Meeting. At the Special Meeting a second appointment took place; and in the name of the Committee it was reported that the following address now laid before the Society had been presented, and the annexed reply received:—

To the Honorable J. P. Willoughby, Esquire.

Honorable Sir,—Having received your resignation of the office of our President, in consequence of your departure from India, we cannot allow you to quit our shores without expressing our high sense of the many and great services you have rendered the Society during the time you have presided over us.

2. We desire to record our estimation of the urbanity, zeal, and ability with which you have discharged the duties of Vice-President and subsequently of President of the Bombay Geographical Society.

3. The assiduous attention you have bestowed on the papers submitted for your consideration,—your constant attendance at our meetings, notwithstanding your arduous public duties,—the ready access given to all on the business of the Society, the valuable papers you have procured for us, and the effective support you have ever afforded to travellers engaged in geographical research, are deeply appreciated.

4. We are sensible that this unanimous expression of our feelings inadequately repays you for the benefits you have conferred on us, but their remembrance hereafter will doubtless offer you no unpleasing reward.

5. While thus addressing you in fulfilment of a resolution of the Society, and on their behalf, we beg to add their heartfelt wish for your happiness and prosperity on retirement from the scene of your successful labours. We have the honor to subscribe ourselves your most faithful servants,

STEPHEN LUSHINGTON.
GRIFFITH JENKINS.
G. LEG. JACOB.
CURSETJEE JAMSETJEE.
G. BUIST.

1st May, 1851.

The following is Mr. Willoughby's reply :—

GENTLEMEN,—I receive with the highest satisfaction the very flattering compliment you have paid me on the occasion of my resigning the office of President of your Society.

The objects for which the Society was established, and most of which have, for some time past, been zealously and assiduously prosecuted by it, claim the active co-operation and support of all who are interested in the extension of geographical knowledge and research, and I can claim no merit for the little assistance which my position has enabled me to afford in furtherance of those objects.

My long connection with the Presidency of Bombay will ever make me take the deepest interest in the various Societies established in it for the promotion of science and literature, and I consider the Geographical Society in a special manner deserving of support.

I need scarcely assure you, that although about to leave India, I shall always continue to take a very deep interest in the proceedings of the Society, and of my desire, if I should at any time have it in my power, to aid in its extension, and in the promotion of the objects for which it was instituted.

Again thanking you for the high honor which the Society has conferred upon me, by presenting this address, I offer to all of those gentlemen who have honoured me on this occasion, my best thanks for the kind sentiments they have expressed towards me, and my warmest wishes for their welfare and prosperity, and that we may at some future period be again associated together in our native land, in the prosecution of researches similar to those to which the attention of the Bombay Geographical Society is directed.

I have the honor to be, &c.,
J. P. WILLOUGHBY.

The following letters &c. were laid before the Meeting :—

LETTERS RECEIVED SINCE THE MEETING OF APRIL.

1—From Corporal R. Leach, 22nd Regiment, dated Dugshai, 27th April 1851, acknowledging the receipt of a Post Bill for Company's rupees 120 ; and offering his services to the Geographical Society as an observer.

2—From Commodore Stephen Lushington, R. N., dated 1st May, intimating his having resigned the office of Vice-President, and requesting to withdraw his name from the list of members of the Society.

3.—From Norton Shaw, Esquire, Secretary to the Royal Geographical Society of London, acknowledging the receipt of the Society's Transactions, vol. IX, and conveying the Society's thanks for this donation. Also presenting his best thanks for the honor done him in electing him a member of this Society, and placing his services at the disposal of the Society.

4—From Captain W. Strange, Nizam's Cavalry, dated Goolburga, 28th April 1851, acknowledging the receipt of an Aneroid Barometer sent to him by banghy.

5.—From W. D'Oyly, Esquire, dated Dhoolia, 7th May, informing of his having remitted through the Civil Remittance list of this month, rupees 103, the balance due by him on account of instruments.

6.—From Commander C. W. Montriou, in charge of the Observatory, Colaba, dated 1st May 1851, forwarding a letter and a book enclosed in a package of books for the Observatory, sent from the Royal Society.

7.—From Thomas Bell, Esquire, Secretary to the Royal Society of London, expressing their thanks for the Society's present of their Transactions, vol. IX.

8.—From John Barlow, Esquire, Secretary to the Royal Institution, London, dated 9th October 1850, returning the thanks of that Society for the Society's present of their Transactions vol. IX.

BOOKS.

Appendix to the Greenwich Observations in 1848, including the results of Magnetical and Meteorological Observations.

On a new Hygrometer, which measures the force and weight of aqueous vapour in the atmosphere, and the corresponding degree of evaporation.

PAPERS.

Researches in the vicinity of the Median Wall of Xenophon, and along the old course of the river *Tigris*. By Commander Felix Jones, of the Indian Navy. Presented by Government, with a letter from A. Malet, Esq., Chief Secretary, No. 2049 of 1851, dated 17th May 1851.

1.—Report of the Survey of the Red Sea, by Captain Elwen, I N.

2.—Particulars of Capt. Elwon's second voyage, and continuance, of the Survey of the Red Sea

3.—Meteorological Journal of Captain Elwon.

4.—Sailing directions for the Red Sea. By Commander Moresby, I. N.

5.—Account of his visit to the Bay of Tajoorah, by Lieutenant Barker, I. N.

6.—Memoir by Captain T. B. Haines, I. N., of the South and East Coasts of Arabia, with remarks on the currents, &c.

7.—Lieutenant Cruttenden's report in reference to the wreck of the Honble. Company's Steam Frigate *Memnon*.

8.—A description of the Arabian Coast, from the entrance of the Red Sea to Latitude 15° 3. North and Longitude 50° 4·3′ East, by Captain Haines. Presented by Government, with Mr Secretary Goldsmid's letter, dated 23th April, No. 1826 of 1851.

1.—Letter from the Resident at Indore, No. 300, dated 26th February 1848.

2.—Letter from A Johnson, Esquire, dated 25th February 1848, to the Resident at Indore, with two Sketches.

3.—Letter from the Resident at Indore, No. 559, dated 3rd May 1848, and copy of Captain Fenwick's Journal of the Passage from Dharee to Hirapal.

4.—Letter from the Resident at Indore, No. 980, dated 21st September 1849, and Captain Fenwick's Journal of the Passage from Chikulda to Broach. Presented by Government, with Mr Secretary Lumsden's letter, No. 383, dated 3rd May 1851.

Meteorological Observations from Trevandrum for February and March 1850; ditto from Calcutta for March; ditto from Belgaum for January, February, March, and April; ditto from Broach for January, February, and March.

The Secretary stated, in reference to the letter of Corporal Leech, that though it was more than probable that his services would be secured for meteorological purposes in the Punjaub, he was too valuable a man to be lost sight of. The Society had at the outset applied to Government (25th March 1845) to provide instruments and agents, and to this Government

consented for the limited scheme then in contemplation: to the more extended scheme to which the Admiralty had proposed to contribute, Government undertook to give all the assistance in their power, the charge of further instruments to fall on the Admiralty grant.*

Mr Leech would be of great value in the management of any of the observatories at the station originally agreed upon by Government, the arrangements of which had not as yet been completed; or should the Imaum of Muscat agree to assist in the researches in which the Society were engaged, Mr Leech would be of the utmost assistance at Zanzibar, from which he might visit Johanna, and arrange for the observations the Society had there contemplated. It was agreed that Government should be written to, expressing the gratification experienced by the Society at the confidence Government showed they had reposed in them and suggesting that it would be more expedient to transfer the entire amount of Rs. 3000 allowed for the publication of observations, to the treasurers of the Society, so that it might be drawn on as required, than to present printing accounts to Government as they fell due.

In reference to the letter of Commodore Lushington, it was moved by W. E. Frere, Esq., seconded by Captain P. T. French, and agreed to unanimously—

"That the Society have received with deep regret Commodore Lushington's resignation of the office of Vice-President, and withdrawal from the Society, and in communicating their sentiments to Commodore Lushington, express the hope that though withdrawn from their body, he will continue to favor them with that assistance which they had already received, and which his high office enabled him to furnish."

The Secretary stated that he had not had leisure to go over the whole mass of papers presented to them by Government, for many of which he believed they were indebted to their late President but such of them as he had read seemed of the greatest value. The papers connected with the Red Sea in particular, though seventeen years old, were in no way out of date, nothing having since then been written on the subject: they would go some way to remove a want that had afforded frequent subject of complaint, and would form valuable companions to the charts they had lately received from Government. They would show, besides, the nature and amount of information still required, and enable the Society to get filled up by degrees the blank space in our accounts in reference to those localities which had so long and so often been traversed. The papers amongst them would go far to form an entire number of their Transactions.

The ordinary business of the Society having been disposed of, that of the Annual Meeting was taken up. On examining the voting lists, the following were declared the office-bearers for the ensuing year:—

List of Office Bearers for 1851-52.

Vice Presidents.

Colonel P. M. Melvill; Captain J. C. Hawkins, I. N.; and the Hon'ble D. A. Blane, Esq.

12 *Resident Members.*

Dr. C. Morehead; Captain H. J. Barr; S. S. Dickinson, Esq.; Captain P. T. French; Commander G. Jenkins, I. N.; Colonel G. Moore; Colonel J. Holland; Dr. J. McLennan; John Smith, Esq.; Norman Oliver, Esq.; Captain J. Estridge; John Ritchie, Esq.

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* Extract from Colonel Melvill's letter, para 2, 1st August 1846,—Transactions of the Society vol. XII., p. XLIV.:—'The Society will remember that they addressed Government on the subject on the 25th March 1845, but that they indicated, as was understood, that the instruments and agents should be provided by Government.)' * * * * Para 8:—"If Agents can be found, Government will endeavour to make their services available, and to construct and appropriate to their use such buildings as may be wanted.)"

8 *Non-Resident Members.*

Major LeGrand Jacob; Major Rawlinson; Captain G. Fulljames; Lieutenant Cruttenden; Dr. E. Impey; Captain Ethersey; W. E. Frere, Esq.; Major John Jacob.

The Committees on Publication and Finance were continued, Mr. N. Oliver having been elected in the room of Captain Ethersey, now absent from the presidency. The following was declared to be the state of these Committees for the ensuing year:—

Committee on Papers.

Lieutenant Colonel James Holland, Chairman.

Norman Oliver, Esq.
Captain H. J. Barr.
S. S. Dickinson, Esq.
} Members. | Commodore G. Jenkins, I. N., and John Smith, Esq. } Members.

Committee on Accounts.

Captain H. J. Barr, Chairman.

Lieut. Col. Holland.
Norman Oliver, Esq.
S. S. Dickinson, Esq.
} Members. | Commodore G. Jenkins, I. N., and John Smith, Esq. } Members.

The Secretary stated that the absence of his colleague, Professor Patton, from the presidency, interfered with some statements that might have been laid before them, and the general report would be submitted to the Committee on Papers when ready. The accounts were in the hands of the finance committee, and the results of the audit would be laid before next General Meeting. It would be seen from the following, that the Society, in the course of the three past years, had added more than a fourth to the number of its members:—

Comparative State of the Society as to Members, from 1845 *to* 1851.

	Members on the list at preceding Annual Meeting.	Members returned to Europe.	Members withdrawn.	Members dead.	Members elected.	Members now in India.	Gain or Loss. Loss.	Gain.
For 1845	77	1	1	2	9	82	„	5
„ 1846	82	5	2	1	7	81	1	„
„ 1847	81	5	4	2	3	73	8	„
„ 1848	73	1	1	0	2	73	„	„
„ 1849	73	6	1	5	21	82	„	9
„ 1850	82	7	4	1	19	89	„	7
„ 1851	89	8*	5	1	13	88	1	„

The Secretary had not as yet received a reply to the letters addressed by them to Major Hamerton, Resident at Zanzibar, or to those addressed to the Society of Ceylon, and Mr. Meldrum at the Mauritius—there had not indeed been time for an answer to the last of these reaching them. Meanwhile Mr. George, the Apothecary on several former occasions alluded to as having been sent to Zanzibar without the Society having had the means of availing itself of his services, had been at the Presidency and expressed his willingness to assist them in any way that lay in his power that did not interfere with the discharge of his more immediate duties. He had accordingly been supplied with one of the Government barometers Mr Mayes had employed at Aden, and with other instruments the property of the Society. In the use of these he had been carefully taught by Mr Mayes, and had been supplied with the fullest docu-

* The members returned to Europe during the last six years amount to 33: they remain on the list of the Society, but do not contribute to its funds during their absence. The bulk of them have retired from the services, and are unlikely therefore further to contribute to the funds.

mentary instructions. He seemed a very intelligent man, and most anxious to promote the views of the Society, with which he had not on leaving Bombay in 1849 been made acquainted. The singular anomalies established by the St. Helena observatory rendered observations to the westward and near the line of the greatest possible interest: and the steps latterly taken by the Board of Ordnance, with which the East India Company had promised to co-operate, afforded an additional stimulus to exertion amongst meteorologists in the East. Mr. George's services would, as matters now stand, be of very great value, especially were a tide-gauge established at Zanzibar: it would at the same time be of much advantage could the Imaum be induced to employ such a man as Mr. Leech, if only for a single year, to complete the enquiry. In the course of the year various of the fragmentary notices laid from time to time before the Society had been put in the form of regular papers, or portions of papers, and been accepted elsewhere: the notices of Luminous Meteors and of Hailstorms in India had been so dealt with, and the results appeared in the Transactions of the British Association for 1850. Various extracts from the report of the last year had been copied into various of the scientific periodicals at home: copies of the diagrams on the walls of the rooms of the Society had been printed in the London Philosophical Transactions, with full acknowledgments of this and other services. The subject of their experiments on the Aneroid had been examined by Sir John Herschell, who expressed himself in complimentary terms on what had been submitted to him: and it appeared as a paper in the last number of the Transactions of the Royal Geographical Society of London. The notice of a probable descent and upheaval of the Earth, as manifested by our littoral formations, in last year's report, formed subject of papers in the Bengal Asiatic Journal, and an article in the Edinburgh Philosophical Journal. It had been the means of affording so large an amount of additional information on this class of phenomen that it was expected to be taken up before the Ipswich meeting of the British Association. Sir Charles Lyell had written that he had "just received their Transactions in time to cite them on a chapter on the Salifera new red or trias" He adds—"Your account of the Red Sea case makes me curious to know the depth of it and of the Straits of Babelmandeb,—the density of the lower strata of water, and the existence or not of an under current; if there is none, there must be some way of relief by deposition." On these points he had been duly replied to He (the Secretary) had on various previous occasions laid before them acknowledgments from men of science at home of the assistance afforded by the Society forwarding them information—transmitting them unpublished papers, or sheets of others still at press: a body which could perform all these tasks efficiently, and pour its contribution of oil, however small, into the lamp of science, seemed to be in a great measure fulfilling the most important of the objects of its existence. The whole of the instruments received by two several despatches had been disposed of, and others asked for they could not supply. On these points the Society would be duly informed by Mr Patton on his return to the presidency; but he (the Secretary) believed that in no single department of exertion had they done more to encrease our stock of knowledge than in inducing gentlemen amateurs to assist in such researches if provided with the means to collect information for them. At some twenty different stations had the means of making observations which would not otherwise in all likelihood have been made, been in this way provided,—and that without pecuniary charge to the Society: the labour, which was considerable, was never grudged —The President said, and the Society seemed fully to concur in his views, that it was hoped they would continue as hitherto to assist in this matter, where so much in the way of assistance of the sort afforded was required, and such ample fruits were secured by it.

Observations made at Port Louis during the latter part of March 1851, with four Barometers and a Thermometer :1st Barometer 15 feet above sea-level ; 2nd, 100 feet ; 3rd and 4th, 40 feet each :

Date.	Hour	Bar.	Wheel Bar.	Fr. Bar.	Ther.	And. Bar.	Winds.	Remarks.
Mar.					°			
14th	10 a m	30·06	30·05	76·525	86	30·065	Easterly	Passing clouds.
...	Noon			76·515		30·02	E	Squall from East.
...	2 p m			76·425	87	29·97		
...	5 p m	30·06					E S E	Heavy rain at 7½ P M.
15	10 a m		30·04	76·43:	84	30·02	E	
...	2 p m		29·94		86		to	Numerous cirrostrati.
...	3 p m			76·265		29·935	E N E	
...	5 p m	30·02			87			
16	10 a m			76·405	86	29·97	N E	Moderate breeze, white cumuli.
...	Noon			76·285	88	29·92		Showers.
...	3½ p m			76·07	87		E to	
...	5 p m	29·93					N	Sea running very high.
...	10 p m				84	29·96	calm	Calm, light high woolly clouds : soon after 10, breeze sprung up.
17	10 a m		29·89	76·086	85	29·96	N N E	Heavy cumuli, higher up cirri.
...	3½ p m			75·97:	86	29·:55		Clouds moving from NNE., but under current from SE. at times.
...	5 p m	29·90		Wind			N N E	Close and oppressive in evening.
...	8 p m			76·060	84	29·895		Calm, heavy cumuli tinged with yellow, below them black scud.
...	10 p m					29·92		At 8 beautiful lunar rainbow at South over Signal Mountain, no rain perceptible there, but noon obscured by dense bank of black clouds 20° above horizon
								At 10 clouds moving from North, but wind very variable below, or chiefly from S E.
18	10 a m		29·90	76·18	85	29·92	N to N by W	Strong breeze, heavy cumuli, light ragged clouds from N.
...	2 p m		29·84		88			
...	4 p m			75·97		29·825	N N W	Wind frequently from N E.
...	5 p m	29·92						Sea agitated.
19	10 a m		29·90		85	29·89	N & N by W	Clouds moving generally from N, but currents of wind sometimes from S E., N E., &c. masses of white cumuli.
...	2 p m			76·075	88	29·8:5		
...	4 p m			76·07		29·805	E & E by S	Showers from E.
...	5 p m	29·91						
20	8 a m			76·03	83	29 92	Extremely variable.	Wind variable ; clouds moving from S S E to S.
...	10 a m			75·975	86	29·875		Clouds from S E and S S E. a little ago wind from S, at 11 A M breeze from N to N E, at noon current of air from S, at 2 P M fine cirri very high towards zenith and South, between 2 and 3 wind from N, soon after from N W ; Sky covered with cirri and cirro-strati, wind again from S S W and S., whirlwinds of dust on streets.
...	Noon			75·95	87	29·80		
...	2 p m			75·835	88	29·745		
...	5 p m	29·79						
...	8 p m			75·78	86	29·73		Walking in a plain in evening found wind from S S E, suddenly shifted to N., then to N E and E. at West number of parrallel horizontal streaks from horizon to 15° above it. At sunset sky brick color at E, after sunset of a reddish glow all over. At 8 P M alternate calms and light puffs.
	11 p m				84	29·72	W N W to N W	Sky hazy, large halo round the moon. Wind coming in strong gusts from N W to W.

Observations made at Port Louis during the latter part of March 1851, with four Barometers and a Thermometer : 1st Barometer 15 feet above sea-level ; 2nd, 100 feet ; 3rd and 4th, 40 feet each :

Date.	Hour.	Bar	Wheel Bar.	Fr. Bar.	Ther.	And. Bar.	Wind.	Remarks.
Mar.					°			
21st	3 a m	29·60						Much rain in the morning.
...	3½ a m	29·66					S W and	Strong gusts from S W, SSW, &c.
...	6 a m	29·67			82	29 67	W S W	Sky overcast with black nimbi,
...	8 a m			75·485	82	29·72	do	very heavy at SE, comparatively
..	10 a m	29·76	29·62	75·60	84	29·145	do	clear at W., clouds moving from
...	2 p m		29·62		84		do	S S W, but strong gusts often
...	2½ p m			75·64		29·72	to W	from W S W ; at 10 A M sky
...	4 p m			75·65	84	29·72	Calm	overcast, but weather more set-
								tled, much thick rain from W S
								W at 4 P M.
...	9½ p m	29 81		75·75				Thunder and lightning at N W.
22	6 a m	29·80			77½		S and	Strong breeze and gusts.
...	8 a m					29·835	S by E	White cumuli and very blue sky.
...	10 a m	29·83	29·74	75·89	82	29·85	S S E	
...	2 p m			75·79		29·845	S S E	Strong gusts from S to S S E, with
								drops of rain; sky overcast, but
								clouds high and apparently mo-
...	3·22	29·82				Aneroid taken away, it being not my own	to	tionless; below them occasional-
...	4 p m		29·72	75·77	78½		S	ly black streaks coming rapidly
...	5½ p m	29·83						from S E.
...	6½ p m			75·79	77		S E to	Strong breeze from S E.
...	8 p m			75 89	77		S E	Wind not so strong; sky overcast
..	9½ p m	29·90						with a continuous and motionless
...	10 p m			76·02			S S E	layer of clouds.
...	Midt.			76·05				Long lulls, with occasional puffs
								of wind from S E to S S E.
23	6 a m	29·93						
...	10 a m			76·165	81		S S E	Sky much cleared; wind abated.
...	3 p m			76·10	79			Light winds.
...	5 p m	29·95			82		S E	Cirri and cirrostrati scattered
								over the whole sky, and tinged
								with red at sunset.
24	10 a m		30.01	76·25	79		S to	Blue sky with white woolly clouds
..	2 p m		29·91	76·12			S S W	
...	4 p m			76·12				Sky red, and puple at sunset.
...	5 p m	30·0		76·16			S S E	
25	10 a m		29·95	76·27	80			
...	2 p m		30·01	76·16			S E	Breeze.
...	5 p m	29·975						
26	10 a m		29·93		81		S S E	Breeze, slight showers.
...	2 p m		29·84	75·99	82		S E	Breeze S E to S S E, small white
								ragged clouds coming from S. E.
								to Northward.
...	5 p m		29 9					
27	6 a m	29·85					E S E	Breeze
...	10 a m			75·96	84		S S E	Strong breeze from E S E to E.
..	Noon		75·91	75·91	87		to	Do do do.
...	2 p m		75·88	75·88			E	
...	4 p m			75·77	84			Lightning at S E at 8 P M.
..	6 p m	29·87						
...	10 p m			75·98				Strong gusts with occasion Showers
								from E; sky very hazy, some
								black nimbi.
28	3½ a m	29·83						
...	5 a m	29·81						
...	6 a m	29·84						
...	10 a m	29·87	29·81	75·95	82		E by S	Very strong squalls and breeze
								from East. to E S E.
...	2 p m		29·76	75·765	83		E by N	Very strong squalls and breeze
								from E b N. and ESE.
...	4 p m			75·81			E	High cirri and cirro-strati, motion-
								less thin white scud moving
								below from E.

Observations made at Port Louis during the latter part of March* 1851, *with four Barometers and a Thermometer : 1st Barometer* 15 *feet above sea-level ; 2nd,* 100 *feet ; 3rd and 4th,* 40 *feet each :

Dates.	Hours.	Bar.	Wheel Bar.	Fr. Bar.	Ther.	And. Bar.	Winds.	Remarks.
Mar					°			
28th	5 p m	29·83						
...	6 p m			75·76	82		E by N	Hard squalls from E b N., occasional showers of thick rain; very dark at NE.
...	8 p m						E	Strong gusts of wind ; flashes of faint yellow lightning, and sometimes bright and white, from SE. to E. ; heavy showers.
							E	
...	9½ p m	29·90						
...	10 p m			76·07	80		E by N	Furious gusts of wind.
29	3½ a m	29·84						
...	6 a m	29·90						
...	8 a m		29·92		81			
...	10 a m	30·00	29·94	76 21	82			Weather greatly moderated : occasional squalls from E. and E b N.
...	2 p m		29·93	75·917	83		E N E	Gusts at long intervals ; heavy detached clouds—high above them dazzling cirro-cumuli.
...	4 p m			75·92			E N E	
...	6 p m	30·00						
...	10 p m			76·109				Sky very hazy ; stars dimly seen through haze ; lulls and languid gusts.
30	1 a m			76·06				
...	6 a m	30·05						
...	10 a m			76·21	84		E N E to	Clouds slowly moving from ENE. to NE.
...	Noon			76·142	85		N E	Light breeze.
...	2 p m			76·087				
...	5 p m	30·07						Lightning at night at S. and SE.
31	10 a m		30·07	76·23	82			Light winds ; numerous cirro-strati at N. ; cirri at W.
...	2 p m		30·02				Var.	
...	3½ p m			76·112				Thunder and lightning overhead from 11 P. M. to midnight.

April 1st and 2nd (particularly 1st), the whole sky presented a most beautiful appearance in the evening, from its being covered with very small white cumuli : it looked somewhat like a furrowed field, or the surface of a lake rippled by a gentle breeze.

***Extract from Log of the Barque "Sydney Griffiths," Captain Cowtan, from Port Fairy towards London.*—(Civil Time.)**

Dates.	Lat.	Long.	Bar.	Ther.	Winds.	Course.	Remarks.
1851	S	E					
Mar.	°						
14	26·49	79·	30·0	82°	Var.		Light, variable, and calm, with sultry air.
15	26·36	78·33	30·1	82	Srd.		Calm, with light airs.
16	26·20	76·33	30·2	80	SE to		Moderate breezes, squally, passing showers.
17	25·53	74·12	30·1	82	ENE		Steady breeze and fine pleasant weather.
18	25·33	71·52	30·0	84	NNE		Moderate breeze and hot sultry weather.
19	25·25	69·46	30·0	84	ENE	WW	Ditto.
20	25·06	67·28	30·0	85	E	WNW	Fine steady breeze with hazy weather ; upper scud still flying from SW. with a heavy SW. swell.

Extract from Log, of the Barque "Sydney Griffiths," Captain Cowtan, from Port Fairy towards London.—(Continued.)

Date.	Lat.	Long.	Bar.	Ther.	Winds.	Course.	Remarks.
1851							
Mar.	S	E					
21	24·55	64·29	29·9	84	E	WNW	Fresh breeze from East with SW. swell, and hazy weather; passing showers; upper scud from SW.
22	25·04	61·05	29·80	84			Increasing breeze and squally, with frequent showers and nasty cross sea.
							Daylight—Carried away fore and main-royal sheets, &c. 8 a. m. blowing a fresh gale, a heavy NE. swell carried away starboard fore. yard arm, topmast, and lower studding-sail, &c.
					E		
			29·70	84			*Noon*—Dark and cloudy, with cross sea; fresh breeze, (steering dead before the wind). 1 p. m. strong easterly gale and squally weather with rain. 2 p. m. hauled down topgallant sails, and doubled-reefed topsails; passed a brig hove to. 3 p. m. gale increasing violently.
						W	
					Steady.		3½ p. m. still increasing; scudding under bare poles, blowing furiously; rain in torrents. 4½ p. m. sea washing deck fore and aft; blowing a most terrific gale; ship on her beam-ends, poop side to windward, blowing a hurricane. 5 p. m. blowing awfully, sea one sheet of foam, vessel sometimes buried in water, main topgallant and royal masts blown away, also the fore one, carrying the fore-top-mast head with it mizen-top-mast gone, also flying jibboom.
			27 20		Lull		5-3 p. m.—A lull; ship righted.
					W		6 30 p. m.—Hurricane commenced again, ship thrown on her beam-ends; helpless.
			27·80	80			7-30 p. m.—Ship again righted.
					SW		8 p. m.—Blowing hard—inclining to moderate; furious sea
							Midnight—moderating fresh gale and dark cloudy weather.
23							*Daylight*—Weather threatening, keeping ship from wind.
							Noon—Fresh breeze, cloudy weather; heavy sea; Sun obscured; course N b E. ½ E. wind SW.
					SW		
			29·90	80	S		3 p. m.—Keeping ship before the wind.
							Midnight—Strong breeze and cloudy weather occasional showers, and heavy S w. swell.
24	23·58	60·28	29 90	82	SW		Swell SW.; sea confused: course N ½ W.
25	22·24	59·42	29·90	80	SW		Fresh breeze from SW.; moderate breeze and cloudy weather, heavy confused sea: course, N b W.
26	20·16	59·15	29.80	82	SSE		Steady breeze with confused cross sea.
							Noon—Squally and threatening weather, confused sea.
			29·70	82			4½ p. m.—Weather very threatening, breeze increasing with heavy cross sea.
			29·80	80	SSW		*Midnight*—Dark squally weather; much rain and heavy sea.
27	19·58	58·17	29·90	80	SSE		

Bar. in Port Louis' Harbour,—on 28th 29.90; 29.h 29·70; 31st 30·00.

Extract from Log of the Brig "Lord Nelson," Captain Gillespie, from St. David's to Mauritius.—(Nautical Time.)

Dates.	Lat.	Long.	Bar.	Course.	Winds.	Remarks.
Mar.	S	E				
16			29·92	E b S	NNE	Fresh breezes and clear weather.
			29·85	E ½ S		*Midnight*—Fresh breeze and cloudy weather.
	31·13	60·50	29·85	E b N		Middle part—Fresh breeze, with light showers.
				ENE		
17			29·90	ENE	N	Fresh breezes and cloudy weather.
			29·80		NNE	8 p. m.—do. do.
			29·82	NE	NNW	*Midnight*—do. do. with rain.
					S E	Latter part—Light wind, thick cloudy weather, sun obscured.
				NNE	to	
					S S E	
18			29·78	NNE	S S E	Strong breeze and cloudy wr. and showers
			29·80	ENE	N	8 p. m.—Light wind, with cloudy weather
	29·2	62·15	29·80	E b N		*Midnight*—Light wind, but clear.
			29·85			Latter part—Calm and clear.
19			29·85		Calm.	Calms and light airs.
			29·90	N	ENE	8 p. m.
			29·92	N b E		*Midnight*—Light airs and clear weather.
	28·18	61·55	29·92			Latter part—Brisk breezes and cloudy weather.
20			29·90	N b W	ENE	Brisk breezes and clear weather.
			29·92	N		8 p. m.
			29·90	N b W		*Midnight*—Fresh breezes and clear weather
			29·85	N ½ W		Latter part, fresh breezes and clear weather.
	26·44		29·90	N b W		*Noon.*
21				N ½ E	E b N	Fresh breezes and clear weather.
			29·80			8 p. m.
			29·81			*Midnight*—Fresh breezes and clear wea.
			29·73			2 a. m.—Bar. inclining to fall—heavy sea setting from Eastward.
			29·70			8 a. m.—Double-reefed topsails.
						11 a.m.—Close-reefed, hauled the courses.
	24·45	6·27	29·20			Sent down main-top and fore yards.
			28·50		E b N	Heavy gale from Eastward.
22			28·40	S b E		3 p. m.—Flying-boom blowing away.
				W	NNW	4 p. m.—A perfect hurricane; heavy sea, ship lying to under balance-reefed try sail on larboard tack.
				S	S W	
				N E		
				N b W	S E	4½ p. m.—Terrific sea struck ship—sweeping boats, cook house, &c. off deck; vessel on her beam-ends. Cut away main mast.
			28·30			
			28·90			*Midnight*—Weather inclining to moderate
	23 35	60·50	29·75		S S W	*Noon*—Weather moderate.
23				NNW	S	Fresh breeze and clear weather.
			29·80			*Midnight*—Cloudy weather, with showers.
						8 a. m.—3 feet water in hold.
24				N b W	S	*Midnight*—Fresh breeze and cloudy wea.
			29·80			Saw large ship to windward with all her masts gone (*Blythwood*); another to Southward, with top gallant mast, jib-boom, and main-top mast gone, (*Sydney Griffiths.*)
			29·90	—*at*	*noon*	
25			29·80	NW.	S	Midnight, strong breezes and cloudy weather with rain.
			29·80	N by W. ½ W.		4 a. m. ditto weather.
	20.14	59·10	29·80			Latter part, ditto.
26						Strong breezes and cloudy weather, with heavy showers.
			29·75			4 p. m.
			29·75			8 p. m.

Extract from Log of Brig "Lord Nelson" Captain Gillespie, from St. David's to Mauritius.—(Continued.)

Date.	Lat.	Long.	Bar.	Course.	Wind.	Remarks.
Mar. 26th			·29·70			Midnight strong breezes and cloudy weather, fresh gales; hauled foresail, and double reefed topsails.
			29·60			Noon—Round Island bearing West 4 miles.

Extracts from Log of Ship "Blythwood" on a voyage from Calcutta to———(Nautical Time.)

Date.	Lat.	Long.	Bar.	Course.	Winds.	Remarks.
Mar. 19th	30·12				SE	First part—increasing breeze, bar. 82°. During night ditto ditto cloudy, 81½°.
	S. E.					A. M. mod. winds and passing showers.
20th	21·10	64·23	3·02		SE.	First part—moderate winds and cloudy weather, passing showers.
			29·90			4 P. M. bar. 82½°
			29·91	8 P. M.		Throughout night, strong winds and passing showers.
			29·91	12 P. M.		
			29·85	4 A. M.		A. M.—Ditto winds and clear weather, with a high cross sea; ship steering very badly, took in all studding sails and flying jib, main royal, mizen top-gallant sail, and spanker.
			29·89	8 A. M.		
			29·84	Noon		Course 8 knots West 183 miles.
21st				S.W. by S.	SE to E.	First part—Strong winds and hazy weather, with a high cross sea, rigged in the studding-sail boom, and sent down main royal yard.
		4 p m	29·74	84½ ther.		
		8 p m	29·88	84½		5 P. M.—sent down mizen and fore top gallant yards; *steered more to South, hoping to allow the cyclone to pass to North,* IF IT IS ONE.
		12 p m	29·61	84		
		4 a m	29·49	83	82½	
		8 a m	29·16	ESE.		
	Calms	12 a m	28·00	SE. Calms		

At sunset clear sky, of a deep indigo blue colour, clouds of orange red. 8 P. M. double-reefed topsails and steered more Southerly. 10 P. M., sent down main top-gallant yard. Midnight, close reefed the topsails. 2 A. M. split the fore topsail. Gale increasing very rapidly: hauled down fore topmast staysail and lay to, head to Southward.

Day-light, blowing a hurricane. 10 A. M., blowing terrific; ship on her beam ends and apparently settling down; cut away mizen-mast and main-mast, ship righting a little, wind blowing harder still, cut the fore top-mast backstays, and the foremast went 5 feet above the deck.

During this time the noise was awful; thousands of artillery could not be louder. The fury with which it blew cannot be described: the binnacle carried away, skylight shivered

three boats' davits, poop, sails, and everything that was exposed, shivered. At the same time sea making a breach into the cabin, and filling it 3 feet deep with water, the rudder, stock, and wheel gone.

About noon the centre of the cyclone passed over us, when there was a calm of about half an hour with *clear sunshine*, during which the barometer rose 2-10ths; no observation for Lat. or Long.

Course Wnd. 22nd
Bar. 28·20
29·50—79°
29·51—79°
29·53—77½°
Course SW.

The first part in the calm centre of a cyclone with nothing standing but the bowsprit, rudder broken and the ship rolling about unmanageable in the trough of the sea; about 1 P. M. commenced to blow with same fury as before from the Westward, so far as we could judge, having no compass, and barometer fell again below 28—4 P. M. the fury of the wind sensibly decreasing—6 P. M. ship pumped dry out; several of the hands disabled by cuts and bruises, and myself with a sprained ancle unable to put my foot on the boards. Throughout the night pumping the ship occasionally, wind gradually decreasing—A. M. hoisted the mizen top-gallant sail on the stump of foremast and a spar over the stern to steer her by and try and get her before the wind—Lat. 23·20 S. Long. 60·19 E.

We must have had about 50 miles current to the South these last 2 days.

Course S.W. 23rd
Barometer injured by sea water.

The first part strong breezes, ship rolling about unmanageable.

About 5 P. M. one of the men who were hurt departed this life.

Sympiesom. 30·10 Throughout night same weather.

A. M.—Ditto ditto.

Noon—Lat. 23·12 S. Long. 60·34 East.

24th—The first part, moderate winds and high sea—Sympiesometer very unsettled, ship would not steer by the spar.

Daylight—Two vessels in sight, one with main and mizen-masts gone, the other much damaged, steering for Mauritius, where they said they would report us.

Latitude observations 22·42 Longitude account 59·45 East.

25th—Threw several bales, that were very hot, overboard. Throughout night strong winds and high seas.

Lat. obs., 21·22 S.; Long. 59·2 E.; had above 30 miles current setting from NNW.

26th—First part, strong winds and passing showers and high sea. Got a top-sail set on jury mast with one reef in it. 5 P. M. saw a vessel standing to Westward, but lost her in a shower. Midnight, sympiesometer 30·15—Noon, sympiesometer 30·00; Lat. obs. 20·23 S. Long. 58·25 E. Easterly current 16 miles.

27th—First part, strong winds with a high sea coming from E. and NW. Throughout night squally and showers. 2 A. M., Round Island bearing NW. 8 miles distant, tried to get between the Coin and Flat Island. Noon, the Coin bearing NW. to W. 4 miles.

28th—First part, strong gales and squalls, steering for the passage between the Coin and Flat Island.

P. M. Passed the Gunner's Coin. 8 P. M. passed Gunner's Point, at about 3 miles distant. Saw the light, we having a light at jurymast head, all night. 10 P. M. saw the lights in Port Louis quite plain. Midnight, Port Louis lights bearing E. by S.; tried to wear ship, but

could not, hauled down all the sails and let her lay to drift as little as possible. Daylight the SW. point of Mauritius bearing SW. by W. and the farthest point seen to the northward N. E.; off shore about 5 miles; hoisted our colours, union down ; but no assistance came, threw overboard 45 bales jute; 8 A. M. wore round, head to northward, and set all sails we could. Noon SW. point bearing South about 10 or 12 miles from nearest coast. Sympiesom. 29-92.

29th—The first part standing to Northward, anxiously looking for assistance ; standing to leeward of Mauritius. 2 P. M. fearing a hurricane ran to Westward to have sea room. 8 P. M. heavy gales and very high sea: hove to on starboard tack and hauled sail down. Daylight, rudder adrift from boards, cut it away.

30th—First part strong gales, ship rolling about. Noon found the lower part of rudder case open and much water coming in; called all hands to get ship lightened aft; no time to observe to-day.

31st—Threw overboard 100 bags of rice, &c. &c.

Lat. 21·6 S. Long. 56·17 E.

5 P. M. Saw Island of Bourbon, Southernmost point bearing W. by S., distant 35 miles; throughout the night squalls, heavy rain and thunder, sea tolerably smooth. Daylight, clouds tinged with red and purple. 8 A. M., Southernmost point of land in sight, off shore 20 miles; Lat. 21·5½ S.

1st. April—Gave orders to make a last effort to get vessel into safe anchorage, but men came aft and said they wished to leave ship, &c. &c. &c.

Gave orders to get boats hoisted out, and left ship at 11 A. M.

2nd.—The first part in the boats with part of our clothes.

6 P. M.—Light on NE. point distant 12 miles. Daylight, stood for farthest out point of land. 11 A. M.—Landed at Port St. Dennis.

[*No Meeting in June.*]

At a Monthly Meeting of the Bombay Geographical Society, held in its rooms, Town Hall, on Thursday 17th July, 1851.

PRESENT.

Commodore HAWKINS, I. N., Vice President, in the Chair.

Norman Oliver, Esquire; Jugonathjee Sunkersett, Esquire; Dr. B. White, Vinayakrow Jagonathjee, Esquire, and Commander GRIFFITH JENKINS, I. N.

The Clerk of the Society informed the president and members that Professor Patton was prevented by illness from attending to the duties of the Society, and that Dr. Buist had sent to inform him that he could not attend on account of public duties.

Commander Griffith Jenkins was requested by the Society to officiate as Secretary.

The following letter from Admiral Beaufort with enclosure was laid before the meeting.

Hydrographic Office, Admiralty, 6th May, 1851.

SIR,—The various communications that you have addressed to me in the name of the Bombay Geographical Society, on the subject of the "Ross Testimonial." have not failed to interest me deeply in the exemplary object which the Society has at heart, the doing honor to the memory of your lamented president. Warmly applauding the useful mode which you have adopted of giving expression to the universal opinion of the service rendered by that distinguished Officer to the advancement of Eastern Hydrography, it is with great satisfaction that by the instant approval of my Lords Commissioners of the Admiralty, I am enabled to add to your collection copies of all the charts that have been published by this Office for the use of Her Majesty's Navy, and I hold their Lordships' commands to forward copies of all that may be published hereafter. They have been duly prepared in folio, corresponding to the Sections of our catalogue, by six copies of which they are accompanied and from the good taste of Captain Becher, who zealously undertook the whole arrangement, I trust they will be found of easy reference, in examining any quarter of the Globe to which our Surveys have yet extended.

In the hands of the Society I have little doubt that they will hereafter be the means of improving our Hydrographic knowledge, by the corrections and additions which will be made by the seamen or traveller who will have access to them.

In compliance with the commission with which you honored me, Captain Becher and I have added to the foregoing, a set of Maps, on Spring Rollers, of the different quarters of the World, and also copies of Arrowsmith's and Johnstone's Atlases, together with a pair of Malby's large globes, corrected to the present time : all these articles are separately specified in Mr Malby's account, which, is herewith enclosed, and the whole collection has been carefully packed, in three strong cases, embarked on board the Ship *Rajasthan*, Nathaniel Steward, Commander, addressed to you, and to sail on the first of this month from the West India Docks.

I inclose one of the Bills of Lading, and shall be anxious to learn their safe arrival, as well as your wishes respecting the disposal of the small surplus, which will remain after the payment of Mr Malby's Account.

I am, Sir,
Your most obedient humble Servant,
(Signed) F. BEAUFORT,
Rear Admiral and Hydrographer.

April 28th, 1851.

THE GEOGRAPHICAL SOCIETY, BOMBAY.....*Dr.*

To THOMAS MALBY and SON.

	£	s.	d.
1 pair of 36 inch Globes	40	0	0
1 ... ... Covers	4	0	0
1 Telescopic Companion			
1 Dr. Morgan's Treatise on the Globes			
To mounting 190 double Elipt. Charts	7	2	6
... .. 712 Single	14	16	8
... .. 1 Antiquarian ditto	0	1	6
... ... 76 Atlases	2	10	8
.. ... 863 Small Charts	10	15	9

	£.	s.	d.
Labelling 1842 Charts	4	6	9
20 Portfolios ½ Bound Russia	20	0	0
20 Sheets of double Elipt. drawing paper mounted, the Indexes of contents of Folios	1	5	0
Writing Indexes	6	0	0
1 General Index, 1 sheet of drawing paper mounted on Millboard, embossed leather border	2	0	0
1 Allen's 6 six sheet Map of India, retail price 2 12 6	2	0	0
Mounting on Spring Roller	3	3	0
1 Cary's Africa	1	1	0
Mounting on Spring Roller	3	3	0
1 Cary's Asia	1	1	0
Mounting on Spring Roller	3	3	0
1 Cary's America	1	1	0
Mounting on Spring Roller	3	3	0
1 Walker's Europe and Allen's overland routes	1	4	0
Mounting on Spring Roller	3	3	0
1 Arrowsmith's Australia	0	8	0
Mounting on Spring Roller	3	3	0
1 Arrowsmith's World	2	17	6
Mounting on Spring Roller	4	10	0
2 Hook sticks	0	7	6
Arrowsmith's General Atlas	13	8	0
To full colouring and inserting the rail-roads, together with Maps of the Islands in the Atlantic, Pacific, Indian Ocean, and British Isles in the West Indies, and Johnstone's Index to places, bound together in half Morocco	4	1	6
1 Johnstone's Physical Atlas, half bound in Morocco	10	10	0
Packing Case for Globes	4	0	0
Tinning	4	11	0
Packing Case for Charts	1	15	0
Tinning	1	6	6
Packing Case for the Maps on Springs	1	10	0
Tinning	1	1	6
Insurance	3	18	0
Shipping Expenses	1	5	9
Cartage to the West India Docks	1	5	6
	£ 195	0	10

It was then proposed by Commodore Hawkins, seconded by Dr White, and carried unanimously,—that the warmest thanks of the Society are due to Admiral Sir Francis Beaufort, Hydrographer to the Admiralty, for the deep interest he has taken in carrying out so ably the wishes of the Society in reference to the "Ross Testimonial."

Proposed by Commander Jenkins, Officiating Secretary, seconded by Jug onathjee Sunkersett, Esq. and carried unanimously,—that the grateful acknowledgments of the Society to Captain Becher be recorded for the able and zealous manner in which he has aided Sir Francis Beaufort in carrying out the wishes of the Society; and that Sir Francis Beaufort be requested by the Society, to convey their grateful acknowledgments to Captain Becher.

The following letters and papers were read and laid before the Meeting.

From Commodore Stephen Lushington, R. N., dated 24th May 1851, acknowledging the receipt of a letter conveying to him, a copy of the resolution passed at the last Meeting of the Society; and requesting to convey his thanks to the Society for the kind manner in which they express their regret at his resigning the office of Vice President, also promising to render them any assistance that lays in his power whilst holding his present Office in Bombay.

From Messrs Smith, Elder & Co., London, dated 6th May 1851, acknowledging the receipt of a letter from the Society, dated 17th January 1851, and intimating their having caused the Society's transactions to be forwarded to Lieutenant Maury, Superintendent of the National Observatory, at Washington, and handing a statement of their account made up to the past year, amounting to £11 19. 6.

From Lieutenant H. G. Raverty, acknowledging the receipt of the Society's letter, intimating their having dispatched to him a copy of the Society's transactions.

From G. J. Blane, Esquire, Acting Civil Auditor, dated the 9th June, requesting to expedite the transmission of the annual Lists of European and Native uncovenanted servants on the Society's Establishment.

From Messrs. Brown, Gardner, & Co., requesting a Pluviometer.

From Lieutenant J. Wray, Belgaum, dated 23d June, intimating his having remitted, through the Military Pay Office, his subscription for 1851.

From Captain G. Wingate, Kulludgee, dated 25th June, enclosing a cheque for 15 Rupees in payment of his subscription for 1851.

From Dr. McPherson, Bolarum, dated 30th of June, requesting information upon Aneroid Barometers.

From F. N. Maltby, Esquire, Mangalore, dated 2d July, enclosing an order on the Oriental Bank.

From J. G. Lumsden, Esquire, Secretary to Government, Marine Department, No. 635, dated 4th July, acknowledging the Society's letter, No. 39, of the 6th of June, and intimating that if the Society will take the necessary preliminary steps of ascertaining where suitable buildings exist, and where the means of Superintendence can be found, Government will insure any moderate expense in fitting up the Gauges at the stations selected. Also promising to insure a reasonable expense, in erecting for their use buildings, on the Society's naming the stations, and the Gentlemen who will undertake the Superintendence.

From Dr. Watson, Ahmednuggur, enclosing a cheque on account of instruments supplied to him.

BOOKS.

Journal of the Bombay Branch of the Royal Asiatic Society, Vol. VI., No. XIV., for January 1851. Presented by the Society.

Journal of the Indian Archipelago and Eastern Asia, for March and April 1851.

PAPERS.

From the Resident at Indore,—Report on the Toorun Mull Hill, addressed to R. N. C. Hamilton, Esquire, Resident at Indore, by Lieutenat Thurburn.

Meteorological Observations, from Mangalore, Cannanore, Calicut, Bangalore, Cuddalore, Chittoor, Nellore, Guntoor, St. Thomas' Mount, Hurryhur, French Rocks, Mercara, Kamptee, Trichinopoly, and Cochin, for the Month of April 1851.

From Secunderabad for the Months of February, March, and April 1851.

From Tavoy for February and March.

From Bellary for March and April.

From Penang for March.

From Coimbatore for March.

From Trevandrum, Calcutta and Belgaum, for May 1851.

THE Bombay Geographical Society held its ordinary monthly meeting on Tuesday the 14th August 1851,—Colonel G. Moore in the Chair. Present:—A. Malet, Esq.; Captain P. T. French; Captain J. Estridge; T. L. Jenkins, Esq.; S. S. Dickinson, Esq.; T. J. A. Scott, Esq. Manockjee Cursetjee, Esq.; Dr R. Haines, M. B.; Dr B. White; Dhunjeebhoy Framjee, Esq.; T. Lancaster, Esq.; Commander G. Jenkins, I. N.; Dr G. Buist, and Professor J. Patton, Secretaries.

The following motions were put from the chair, and agreed to unanimously:—

1.—That since last Meeting of the Society, intelligence has been received of the demise of its Founder and first President, Sir Charles Malcolm, under whose auspices it first obtained distinction, and whose anxiety to promote the objects it had in view, and to advance its interests, continued unvaried to the close of a long and valuable life.

RESOLVED,—That the Society do record its grief for the loss it has sustained by his removal—[a portrait of him which adorns their Rooms, was subscribed for in token of their respect and regard for him when he retired from India.]—Proposed by the Chairman.—Commander Jenkins requests permission, as an old friend, to second the resolution.

2.—That the duplicate and spare Specimens of Minerals in the collection of the Society be presented to the Education Board for educational purposes.

3.—That a Committee of three be appointed to report on the best mode of disposing of the various articles forwarded by Sir Francis Beaufort as part of the Ross Testimonial; and that of this, Commander Jenkins be requested to become a member.

S. S. Dickinson Esq, Commander G. Jenkins and John Ritchie Esq. were appointed a Committee accordingly.

The following report on the Wind and Current Charts was read, and directed to be received by the Society. The Committee was declared dissolved—their records to be placed at the disposal of the Society:—

Report of the Committee on Wind and Current Charts, to the President and Members of the Bombay Geographical Society.

GENTLEMEN,—At the date of your last Report your Committee had transmitted home the sheets of the Wind and Current Charts with the view of having an estimate made of the charges attendant on their publication, and they now learn that the cost of printing 200 sets, or 6200 sheets in all, will amount to £280, besides shipping and other charges; and the Committee would

now respectfully recommend that the Society should decline proceeding further in the matter, and that the Charts themselves should be returned to the subscribers.

Dr Buist moved—

"That the Society do not proceed further in the matter of the Manual of Physical Research, in process of completion; and that the advances made from its funds to account of printing, be refunded."

The motion was agreed to unanimously. It was stated, in reference to the refund of Rs. 800 which had been already made, that the Manual was expected to meet its own charges, and would be proceeded with exactly as before, excepting that it would not appear under the auspices of the Society.

The Chairman then called Mr Mayes, who was in attendance, and read to him the following resolution :—

That Mr Mayes be now presented with the "Chronometer," procured for him in terms of the Resolution of the Society of the 24th of April, 1851. Mr. Mayes first came under the notice of the Society through the honorable mention made by the Marquis of Northampton before the British Association in 1842, of his name while serving at Aden, where he conducted a series of Meteorological Observations. In 1845, he was recommended to Government by the Society as a fitting person to superintend the Observatory then in contemplation at Aden, where he continued from 1846 to 1851, to perform the various important tasks assigned to him, in such a manner as to meet the approval of all with whom he was connected. On the 24th of April the following resolution was agreed to unanimously :—

"That with reference to the Papers and Instruments produced before the Meeting, obtained by his own resources, and to mark the high sense which the Society entertain of his meritorious and valuable services, in promoting the objects of the Society, a Chronometer of the value not exceeding £50, with a suitable inscription, be presented to Mr. Mayes."

Colonel Sykes having been applied to, with the advice of Colonel Sabine and Captain Smith, procured a Chronometer Watch from Mr. Dent, such as they considered best suited to meet the wishes of the Society, and prove serviciable to Mr. Mayes.

Mr. Mayes expressed his gratitude to the Society, and withdrew.

The correspondence on the Ross Testimonial already published, having been disposed of, the following letters from Lieutenant Maury, of the Observatory at Washington were laid on the table :—

National Observatory, Washington, 8th March, 1851.

Dear Sir,—I have this morning your favor of 17th January last, for which, and your kindness be pleased to accept my thanks.

The volumes of Transactions have not arrived: I presume though that they will be here in the course of a few days. I shall present, in your name, the duplicate copy to the National Institute Washington.

Your best plan, perhaps, to send parcels for this country, would be to send them to me, and I will with pleasure, distribute them according to your wishes.

I send you six complete sets of my Wind and Current Charts. Please accept one set for

yourself, present another set to the Bombay Geographical Society, and dispose of the others "as it seemeth good unto you."

I also send you, for like use and disposal, a number of pamphlets, six copies, on the relation betwen Magnetism and the Circulation of the Atmosphere. This paper is from the forthcoming volume of Observations: a limited circulation only has been given to it, and I should be pleased, if the same be in conformity with your rules, to have it read before your Geographical Society.

I did not feel myself capable of offering you any advice worth having as to the publication of the very valuable Charts which you have in process of construction. I am very much in want of materials for my Charts relating to your seas,—and this occurs to me. If you can gain access to any number of old log books, which contain the direction of the wind once for every eight hours, and which give daily the temperature of air and water, though this last shall not be a sine qua non, I will pay for abstracts therefrom at the rate of two cents the day,—i. e. suppose the copyist makes the abstract from the log of a vessel that has been 100 days at sea, he will receive therefore $ 2.

The tracks which I want on these terms, relate to the Indian Ocean only,—calling that the Indian Ocean which extends South from Asia between Africa and New Holland and which is to the Westward of a line drawn from New Guiana to China. This is the region as to which I am most lame of materials, and for abstracts of which I will agree to pay as above. If you deem it expedient to employ one or more copyists on these terms, you are at liberty to retain copies of any or all of such abstracts for your own work that will be of use to you. I have employed copyists at this rate of 2 cents per day for other parts of the ocean, and a quick writer can easily earn dlrs. 6 or dlrs. 8 a day.

I shall, in the course of a short time, do myself the pleasure of sending you other forthcoming publications. You will from them perceive the actual advantages which the practical Navigator has derived from these Charts, stated in the least favorable forms. It should afford encouragement to the generous spirits that sympathize with you in your noble efforts.

I shall be happy to receive the Geographical papers to which you allude.

I have succeeded in tracing out the locality of two streams of warm water which have their genesis in the Indian Ocean, and at least two streams of cold water that run into it.

One of the former has its exodus through the straits of Malacca, with waters hotter than those of our Gulf stream. I am in search of another, which I have reason to believe ought to be found somewhere between New Holland and Borneo. Perhaps this joins the other, for it is now well established by my researches, that Origon owes its mildness of climate to the hot waters of a "Gulf Stream" in the North Pacific. The Northern Indian Ocean with its Seas, Bays, and Gulfs, is the cauldron which performs the office of a furnace in tempering the climates of North Western America as well as of New Zealand and Extratropical Australia.

However, I have made it a rule not to offend prejudices by venturing speculations in advance of my work, and I should therefore conform more strictly to this rule by saying that I have some indications of such currents.

I shall send this and the parcel through your Agents, Smith, Elder & Co. I regret that I cannot send it without cost to you; but this I can do only to their hands.

If you will have the kindness to direct forward any thing that you may send to care of my Agent, George Mouning, No. 90 Wall Street, at York, it will reach in safety.

Your much obliged friend,

M. F. MAURY.

Dr George Buist, L. L. D., F. R. S. &c., Secretary to the Geographical Society, Bombay.

P. S.—I also send three copies of my "Gulf Stream."

National Observatory, Washington D. C.

April 21st, 1851.

MY DEAR SIR,—I have this morning your esteemed favor of March 3rd. On the 8th of same month I wrote in acknowledgment of your former communication, and thinking perhaps that I might possibly assist the Society, while I served myself, authorised you to have copied, abstracts of sea journals, according to form, at 2 cents per day.

I hope that letter has reached you, and that I have been understood with regard to the offer.

None of the packages alluded to by you have been received, except the copy of the *Bombay Times* containing the discussion, relative to the Charts, which took place in the Society. I thank you heartily for it.

In the exercise of the discretion thus given, and in behalf of Dr Buist and the Society, I present the set of the Transactions of the Bombay Geographical Society alluded to above, to the Library of the Smithsonian Institute. I shall so inform the Doctor.

Respectfully, &c.,

(Signed) M. F. MAURY.

PROF. JOSEPH HENRY, Sec. Smithsonian Institute, Present.

The following Letters, Papers, and Book, received since last meeting, were laid on the table, and their donors desired to be thanked for the same :—

LETTERS.

From Dr. McPherson, Bolarum, dated 21st July 1851, presenting thanks to the Secretary for his communication of the 8th instant, and informing of his being unable at present to avail himself of his friendly offer to procure the instruments in the mode proposed by him.

From Lieutenant A. B. Kemball, Bagdad, dated 15th April 1851, enclosing an order on account of his subscription for 1850-51.

From Captain S. B. Haines, Aden, dated 19th July 1851, enclosing an order on account of his subscription for 1851-52.

From Dr. Impey, Indore, dated 7th August, enclosing an order on account of his subscription for 1851-52.

From Messrs Smith, Elder & Co., London, dated 24th June 1851, informing of their having forwarded by the steamer of the 20th instant from Southampton, a small parcel containing a silver Chronometer Watch.

From A. Malet, Esquire, Chief Secretary to Government, No. 3561 of 1851, dated 6th August 1851, under the Political Department, transmitting, for presentation to the Geographical Society in the name of Government, and for publication, should such be deemed by them advisable, a copy of a report on the 'Toorun Mall' by Lieutenant Thurburn.

From Messrs. Smith, Elder and Co., London, dated 7th July 1851, enclosing Mr Dent's account for the chronometer, (since received), and intimating of their having paid Messrs. Denney, Clerk and Co., £ 2.10.8. Also informing of their having shipped per 'Seringapatam' a case containing charts received by them from Lieut. Maury, for the Bombay Geographical Society.

From Lieutenant Maury, National Observatory, Washington. From Colonel Sykes.

PAPERS.

Report on the Toorun Mall Hill, by Lieutenant Thurburn, addressed to R. M. C. Hamilton, Esquire, Resident at Indore. Presented by Government.

METEOROLOGICAL OBSERVATIONS.

From Calcutta, Trevandrum, and Belgaum, for the month of June 1851.

From Sattara, for the months of March, April, May, and June.

From Dharwar, Bhooj, Ahmedabad, Sawuntwarree, Ports of Cuddalore and Coconada, Allaugh, Civil Hospital Kolapoor, and Broach, for the months of April, May, and June 1851.

From the stations of Secundrabad, Bellary, Cuddapah, Kurnool, Coimbatoor, Madeira, Penang, Trichinopoly, and Cochin, for the month of May 1851.

From the stations of Cochin, Compta, Calicut, Bangalore, Mercara, Hurryhur, and French Rocks, Garrison Hospital Trichinopoly, Jail Hospital of Palamcotta, Garrison of Cannanore, and Zillah of Mangalore, for the month of June 1851.

Statement showing the numbers and details of the Military Guards employed in the Zillah of Rutnagherry at the requisition of the Collector and Magistrate, for the month of June 1851.

Meteorological Register of Observations taken with the Aneroid Barometer and Mason's Hygrometer every 2 hours from 6 A. M. to 4 P. M. daily, from 1st March to the 15th June 1851, at Ramandroog, by Captain A. R. Dallas, Deputy Assist. Qr. Mr. General, Ceded Districts.

BOOK.

Annual Report of the Elphinstone Institution for the year 1850. Presented by the Board of Education.

Other notice matters having been disposed of, the Society adjourned.

Commander Jenkins gave notice of a motion in reference to the letters of Lieutenant Maury, to be brought forward next meeting.

The ordinary Monthly Meeting of the Bombay Geographical Society took place in its rooms, Town Hall, on Thursday the 11th September, 1851—Captain GRIFFITH JENKINS, I. N., in the chair.

PRESENT.

John Ritchie, Esq.; Dhunjeebhoy Framjee, Esq.; Vinayakrow Jagonathji, Esq., and Professor Patton, Secretary.

Before the Meeting proceeded to any of the usual business, it was moved by the Chairman, and seconded by John Ritchie, Esq.,—

That the Society record its deep and sincere regret for the awfully sudden removal of Captain J. C. Hawkins, I. N., one of their Vice Presidents.

The minutes of last Meeting having been read and confirmed, the Chairman stated that in

reference to the notice of motion given by him at last Meeting, he should not propose anything to the Society, but leave to the Secretaries to reply to Lieutenant Maury as they considered best.

The Secretary read the following paper on the Correction of the Barometer for Pressure of Moisture:—

This Society has always taken a great interest in all questions connected with Meteorology, and I hope they will now bear with me while I make a few remarks on a question that is at present exciting some attention. I mean the influence of the vapour in the atmosphere on the barometer. According to the received theory, vapour mingles with the dry air of the atmosphere as if the dry air were a vacuum to it, and consequently its elastic force is added to that of the air, and their united force is shewn by the height of the barometer. It is of great importance that this question should be decided, for observations on the barometer can be of little use until we have some knowledge of what they really indicate. If the proportion of vapour to the other constituents of the atmosphere were constant, it would be a matter of indifference what that proportion is; but we find that its variations are greater than those due to any other cause. It is therefore necessary to decide whether the tension of vapour is additive, or simply takes the place of a portion of dry air. The latter position is what I wish to maintain.

The incorrectness of the present mode of ascertaining the weight of dry air in the atmosphere, may be established in two ways,—either by shewing that the foundation of the theory is false, or that the results are inconsistent with the known state of the atmosphere.

1st. The theory that has long held sway among Chemists and Natural Philosophers that one gas is a vacuum to all others, and that consequently the elastic force of a mixture of gases is the sum of the elastic force of the separate gases, is the necessary basis of the whole. It is unnecessary to multiply authorities on this point, for it is entwined with the whole modern system of Meteorology. Mr. Glaisher, of the Royal Observatory, has stated it very distinctly. "As in an atmosphere of pure steam, the force of it at the earth's surface would be its weight, so in a mixture of atmospheres, the elastic force of each at the earth's surface is the weight of the whole atmosphere of each kind. Therefore the elastic force of vapour representing the weight of the entire mass of aqueous vapour diffused throughout the atmosphere, expresses the pressure on the surface in the cistern of the barometer produced by the vapour present in the air at the time of observation, and it therefore becomes a correction to be applied subtractively to all readings of the barometer, to obtain from them the pressure of the atmosphere of dry air." Both of these principles we question,—that the elastic force of the separate components at the earth's surface is the weight of the atmosphere of each kind, and that the pressure of vapour becomes a correction to be applied subtractively to obtain the pressure of dry air. Now a very simple experiment will show this. Place a glass jar over a candle standing on a table, and depress the jar until it is within about a tenth of an inch from the table on which the candle is standing. In less than a minute the candle will be extinguished. Now this can only be explained by supposing that the gases within the jar prevent the ingress of the oxigen to take the place of that which has been consumed by the light. If the nitrogen within were a vacuum to the oxygen, there is sufficient place for it to enter. The one gas therefore does act upon the other. The same thing is seen in many chemical experiments, where one gas, such as chlorine, being put into a vessel drives the other out. If then one gas presses on another, and when intermixed removes it from its original position, there is no reason whatever for supposing that the same does not take place between air and vapour. It is unnecessary here to enter more at length on this subject, which is more properly a question of Natural Philosophy, my

object is simply to direct attention, to its bearing on Meteorology. If the oxygen and nitrogen of the air can act upon its vapour, it is no longer true that the elastic force of the vapour at the surface is the weight of the superincumbent vapour, and consequently, it would give a very false idea of the quantity of dry air to subtract the tension of vapour from the height of the barometer in order to find the weight of the dry air.

2nd. But the incorrectness of this mode of correcting the barometer for pressure of moisture will be perhaps more clearly established by showing that the quantity of vapour required to produce the tension at the surface cannot exist in the atmosphere. The data required are the tension, and weight in a cubic foot of air, of vapour at various temperatures, and also the temperature air at various heights above the surface of the earth. The first two are very well known, and may be found in various authors, easily accessible in the Greenwhich Meteorological Observations for 1847, in the Bombay Observations for the same year, in Glashier's Tables, and in the Manual of Physical Research now being prepared by my colleague. The law of the decrease of temperature according to the height above the surface, is yet unknown, but a sufficient number of experiments have been made for our present purpose. The limit of perpetual snow at the equator is less than 18000 feet above the surface, and at the outer limit of the atmosphere the air must have the temperature of space which M. Pouillet has proved to be lower than the point at which carbonic acid becomes a solid. If the temperature were accurately known at every point of a vertical line, it would be a simple question of arithmetic to find the total weight of vapour that would saturate each part, and this might then be compared with the tension at the lowest point in order to discover whether the tension is produced wholly by the weight of the superincumbent vapour. I have made this calculation from the two following series of observations made by Humboldt in South America, and Gay Lussac at Paris.

Humboldt.		Gay Lussac.	
Height in feet.	Temperature	Height in feet.	Temperature
...	81°5	...	87°35
8281	71°2	9945	54° 5
6562	65°1	13987	53° 6
9843	57°7	16405	41°45
13124	44°6	18471	32°
16405	34°7	20149	26°18
19686		22885	14° 9

In order to take the most unfavourable supposition to my own views, I assume that the air between any two points of which the temperatures are known is saturated with vapour of the temperature of the lower point. The calculation will stand thus.

Temperature of Dew Point.	Grains in a cubic foot of vapour.	Weight of vapour between two points of observations.	Temperature of Dew Point	Grains in a cubic foot.	Weight of vapour between two points of observations.
81°5	11·27	36977	87°35	13·52	134456
71 2	8·25	27068	54·5	4·94	19967
65·1	6·89	22608	53·6	4.81	10830
57·7	5·36	17586	41·45	3.22	6632
44 6	3·5	11583	32·	2·37	3977
34·7	2·58	8475	26·18	1·94	5308
		6234			
	Total	130531		Total	181190

It appears therefore, that the total weight of a column of vapour of 19686 feet in height, and base a square foot, would be 130531 grains if the dew point were 81°35 at the base and the whole column saturated. At this height the barometer would stand at about 13 inches, and consequently only 3-7ths of the atmosphere exists above that height. In the case of this vapour there must be a much smaller proportion of the whole above this height, because, unlike the air, it is condensed by cold. If one half be added to the above sum, the whole weight of vapour that can exist will be equal to 195798 grains. But this weight of 195798 grains is only equal to a column of mercury of 395 inches, because a column of mercury of the same base and one inch high is 495,833 grains. When the temperatures are assumed the same as in M. Gay Lussac's experiment, the total weight of a column 22,885 feet in height is 181,190 grains; when the temperature of the dew point at the base is 87°·35, if one half be added to this for the vapour above this height the total weight will be 271,195 grains, or equal to 518 inches of mercury.

In the former case the total weight is only equal to the tension of vapour at the temperature of 53°, although the air was assumed to be saturated at the temperature of 81°5, and in the latter the weight is only equal to the tension of vapour at the temperature of 62°, the actual temperature being 87°·35.

In the Bombay Observations which we have just received, there is frequently a pressure of moisture above an inch, and we have seen that the weight of all the vapour that can exist in a vertical column when the temperature of the lowest point is 87·35, would only produce a pressure of moisture equal to 588 inches. Of course the temperatures which have been assumed are not strictly accurate, but from the mode of calculation the error will be on the side of excess of vapour. Every thing being taken into consideration, I do not think that there is ever as much vapour in the atmosphere as would produce a pressure of half an inch of mercury. I have applied a simlar calculation to the theoretical temperatures at various heights given by Sir John W. Lubbock in his essay on Heat and Vapours, and as the height can be divided into a greater number of intervals, the result is probably much nearer the truth than those given above. I do not insert the calculation, because it gives a much smaller amount than has been found from actual observations, and because the law of temperatures given by him may be objected to.

In this calculation we have endeavoured to find what would be the weight of the vapour that can exist in the atmosphere, and we have found that it by no means corresponds with that indicated by the tension at the lowest point, but the same may be proved, perhaps more satisfactorily, by calculating what quantity of vapour would be required to produce the pressure at the lowest point. If this be found greater than can exist in the air, it will be an ad-absurdum argument against the theory we are combating. The following table gives the temperature of dew point, elastic force of vapour, the number of grains in a cubic foot of vapour, and the height to which an uniform column of vapour must extend, so that its weight should be equal to the tension at its lowest point. The second and third columns are taken from Glashier's tables, and the fourth is calculated thus—when the dew point is 90° there are 10·81 grains of vapour in a cubic foot of air: how many feet high must the column extend so as to produce the tension of 1·001 inches of mercury, the weight of one inch of mercury on the same base of a square foot being 495,883 grains? The answer is 45,913 feet.

Temperature of Dew Point.	Tension of vapour in inches of mercury.	Grains in a cubic foot.	Height of a homogenous column whose weight is equal to the tension.
10	·039	1·11	39756
20	·129	1·58	40482
30	·186	2·21	41730
40	·264	3·09	42362
50	·373	4·23	43211
60	·523	5·87	44177
70	·727	8·00	45058
80	1·001	10·81	45913
90	1·367	14 49	46777

The results given in the last column show what amount of vapour must exist in the atmosphere to produce the tension at the lowest points and this is so much greater than what is possible under the known conditions of the rapid decrease in the temperature in ascending the surface, that I feel quite satisfied that the theory cannot be maintained. The science of Meteorology has frequently suffered from too ready reception of first principles, and the attention of its promoters has been turned from questions of real importance to the science to others of only local value. For example, this reception of the theory of the hygrometer, and belief that it gave the total quantity of vapour, has discouraged any attempts to approximate, to the truth by other means. Up to the present time I do not know of any series of observations on evaporation that are of the slightest value. It is obvious that those made in shallow vessels either in the sun or shade, exposed to a current of air or protected from it, do not represent anything that takes place over any considerable portion of the earth's surface. I would therefore recommend to the Society to endeavour to obtain, from different stations on the coast, the Mauritius, and other places, observations of the amount of evaporation from the surface of the sea, tanks, and earth. The evaporation from the surface of the earth might be obtained by an instrument such as was suggested by Dr. Buist some time since, but inserted into the earth so as to be in exactly the same circumstances as the surrounding soil. The evaporation from the surface of the sea which is the most important element of the total evaporation, would be easily found by the evaporation from the surface of a vessel sunk into the sea so as to have the water within in exactly the same physical conditions as the sea itself.

To prevent any misconception of my meaning, I must repeat, that while I deny that the correction of the barometer for pressure of vapour is to be made by subtracting the tension of vapour at the surface. I do not believe, as some have done, that the presence of vapour diminishes the only thing that we can with confidence assert on the subject is, that the barometer shows the weight of the whole vertical column; what may be the weight of the several parts, depends on their vertical distribution. This principle carefully examined, will lead to some interesting results, to which I hope soon to be able to direct the attention of the Society.

A discussion ensued in reference to several points connected with this paper, and Commander Jenkins volunteered to commence a preliminary series of observations in Bombay Harbour in the manner suggested.

The maps, charts, and globes, of the Ross Testimonial, having just been opened, were exhibited before the meeting, and the committee which had been appointed at the last meeting to superintendent the disposition of them, commenced operations.

The following letters, papers, and books, received since the last meeting, were laid on the table, and their donors desired to be thanked for the same.

LETTERS.

1. From Dr Morehead, Principal, Grant Medical College, No, 50 of 1851, dated 15th August, transmitting for the Library of the Society, a copy of the Report of the Grant Medical College for the Session 1850-51.

2. From Brigadier Reid, Ahmednuggur, dated 27th August 1851, acknowledging the receipt of the Society's letter of the 20th instant, and informing that Captain Gaisford, Instructor of the Artillery Depot, or Surgeon Mackenzie, of the Artillery, will be most happy to take charge of the self-registering wind and rain-gauge the Society contemplate employing at that station.

From Commander Montriou, Superintendent of the Observatory, dated 25th August, forwarding, by direction of the Right Hon'ble the Governor in Council, for presentation to the Bombay

Geographical Society, 1 copy of the 2nd part of the Observations made at the Colaba Observatory for 1847.

From Commander Montriou, Superintendent of the Colaba Observatory, forwarding 1 copy of the results of Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, sent from the Royal Society for presentation to the Bombay Geographical Society.

From Captain H. B. Turner, Superintending Engineer, S. P., Poona, dated 5th September, acknowledging the receipt of the Society's letter, No. 52 of 20th August 1851, on the subject of the registering wind and rain-gauge the Society contemplate establishing there.

From C. M. Harrison, Esquire, Ahmedabad, dated 1st September, enclosing a hoondee for Rs. 30, on account of his subscription for 1850 and 51.

Books.

1. Annual Report of the Grant Medical College for the session 1850-51. Presented by the Principal.

2. Journal of the Indian Archipelago and Eastern Asia, for May 1851. Presented by Government.

3. A Grammar of the Punjabi Language, with Appendices. Presented by Sir Henry Elliot.

4. A Geographical Description of the Punjaub in Punjabi. Presented by Sir Henry Elliot.

5. Journal of the Ceylon Branch of the Royal Asiatic Society, for 1850. Presented by the Society.

6. A Memoir upon the Geological Action of the Tidal and other Currents of the Ocean. By Charles Henry Davis, A. M., Lieutenant U. S. Navy.

7. Bombay Meteorological Observations, Part II. for 1847. Presented by Government.

8. Results of the Magnetical Observations made at the Royal Observatory, Greenwich, for 1849. Presented by the Royal Society.

Papers.

Meteorological Observations from Calcutta, Belgaum and Trevandrum, for the month of July.

The ordinary monthly meeting of the Bombay Geographical Society took place in their rooms on Thursday the 9th October—A. Malet, Esq., chief secretary to government, in the chair. Present—Commander G. Jenkins, I. N.; Dr. R. Haines; S. S. Dickinson, Esq.; Manockjee Cursetjee, Esq.; and Dr. Buist, joint secretary.

On taking the chair, Mr. Malet moved—"That the Society do record an expression of the deep grief it experiences for the loss of one of the oldest and ablest of its members—Captain J. P. Sanders, I. N., whose contributions had so often adorned the pages of their Transactions."—Seconded by Commander Jenkins, and agreed to unanimously.

The following Report of the Committee appointed to arrange for the disposal of the Maps and Charts received by the Rajasthan as part of the "Testimonial," was read:—

Report of the Committee on the 'Ross Testimonial.'

"The Committee proposed that a book-case be provided to contain the charts and books, to be placed at the south end of the room, where they propose to place the painting of Captain D. Ross over it, where at present the painting of Sir C. Malcolm is; and to place in two large boxes, open

on the lower side, the 7 roll maps, to be attached to the ceiling on the north side. The two globes can be placed in the two corners at each end of the book-case."

Moved by Dr. Haines, seconded by Dr. Buist, and agreed to unanimously—"1. That the Committee receive the thanks of the Society. 2. That their Report be approved of, and received. 3. That the members of the Committee be re-appointed to carry their own recommendations into effect."

The following is a set of abstracts, from all the trust-worthy English observatories so uth of Lat. 44° hitherto published, arranged according to latitude:—

Names of Places.	Months.	Mean Max. for the Month.	Mean Min. for the Month.	Mean of the Month.	Mean of the Year.	Mean Daily Tide for the Month.	Mean Yearly Range.	Yearly fall of Rain.	Latitude.	Long.	Elevation in feet.
		A	B	C	D	E	F	in.			
1 Trevandrum ...	June.	29·726	29·674	29·694	29·736	·052	·179	64·54	8°30′ N.	76°59′ E.	130
	Dec...	29·899	29·762	29·792		·067					
2 Dodabet.	June.	21·992	21·940	21·966	22·046	·052	·183	101·12	11°23′22″	76°47′	8640
	Dec...	22·073	22·013	22·043		·060					
3 Aden. ...	June.	29·542	29·395	29·457	29·677	·147	·620		12°46′26″	45°25′	187
	Dec...	29·863	29·745	29·805		·118					
4 Madras...	June.	29·716	29·592	29 664	29·835	·124	·481	49·19	13°04′11″	80°21′58″	27
	Dec...	30·073	29·968	30·013		·105					
5 Chitoor .	June.	28·937	28·869	28·903	28·584	·068	·475		13°15′	79°10′	
	Dec...	29·344	29·212	29·278		·132					
6 Cawnpoor.....	June	29·129	29·045	29·087	29·357	·084	·631				
	Dec...	29·676	29·580	29·628		·096					
7 Sawunt Warre..	June.	29·410	29·370	29·391	29·483	·040	·324	76·25	15°56′	74°	387
	Dec...	29·694	29·598	29·646		·106					
8 Guntoor.	June.	29·788	29·741	29·754	29·924	·047	·462		16°17′	80°32′	
	Dec...	30·178	30·035	30·108		·143					
9 Poona ...	June.	27·821	27·715	27·768	27·925	·106	·308	26·57	18°30′		1832
	Dec...	28·123	28 013	28·068		·110					
10 Bombay..	June.	29·663	29·587	29·621	29.796	·076	·394	76·08	18°52′35″	72°49′5″	36
	Dec...	29·970	29·846	29·897		·124					
11 Calcutta.	June.	29·507	29·425	29·465	29·724	·084	·606	62·09	22°34′40″	88°28′15″	18
	Dec...	30 028	29·919	29 974		·110					
12 Hoshungabad....	June.	28·658	28·489	29·573	29·832	·169	·669	11·20	22°41′	77°54′	1140
	Dee...	29·158	29·015	29 086		·143					
13 Nursingpoor.....	June.	28·501	28·361	28·431	28·654	·140	·608		22°57′	79°38′	1120
	Dec...	28·969	28·834	28·901		·135					
14 Berhampoor.....	June.	29·453	29·382	29·417	29·662	·071	·465		24·4	89·14	
	Dec...	29·922	29·826	29·874		·096					
15 Kurrachee.....	June.	29·432	29·863	29·397	29·702	·069	·604		24°47′19″	65°3′37″	
	Dec...	29·967	29·898	29·932		·069					
16 Benares..	June.	29·420	29·311	29·365	29·620	·109	·572		25·30	83·1	
	Dec...	29·864	29·766	29·812		·112					
17 Lucknow	June.	29·152	29·023	29 087	29 360	·129	·682		26·51	80·55	
	Dec...	29·705	29·592	29·644		·113					
18 Futtygur	June.	28·869	28·736	28·801	29·126	·130	·777	30·56	27·21	73·54	
	Dec...	29·513	29·395	29·454		·118					
19 Katmandhoo.....	June.	25 206	25·114	25·160	25·299	·092	·379		27·44	85·15	
	Dec...	25·493	25·383	25·438		·112					
20 Dehli. ...	June.	28·813	28·714	28·763	28·954	·099	·609		28·41	77·5	
	Dec...	29·255	29·158	29 207		·079					
21 Mozufferpore. ...	June.	29·204	29·133	29·168	29·441	·071	·629				
	Dec...	29·762	29 660	29·711		·102					
22 Simla. ...	June.	23·784	23·723	23·753	23·860	·061	·604		31·05	76·55	7200
	Dec...	24·092	24·041	24·066		·051					
23 Toronto.	June.	29 617	29·560	29·584	29·612	·057	·217		43°39′38″ S.	79°2′4″30 W°	107
	Dec...	29·679	29·623	29·648		·056					
24 St. Helena	June.	28·352	28·286	28·309	29·281	·066	·154		15°59′41″ S.	5°40′51	
	Dec...	28·268	28·193	28·233		·070					
25 Hobartown. ...	June.	29·822	29·768	29·798	29·789	·034	·498		42°52′5″	147°27′5″	
	Dec...	29·716	29.635	29·668		·081					

NOTE.—In column A, is given the Mean of the Maximum for the month, in column B, the Mean of the Minimum for the month, in column C, is given the Mean of the Month as reduced from the whole of the observations taken either hourly or otherwise as will be shown hereafter; in column D, is given the Mean of the year as reduced from the total number of observations taken in the year column E, is found by subtracting B from A column F, is found by subtracting June B from December A in North Latitude and reverse South Latitude, when this does not give the result of the column it shows the Minimum or Maximum has diverged from the general law, and fallen on some other month.

LETTERS.—From C. Meldrum, Esq., Royal College Mauritius, dated 20th Aug., 1851, acknowledging the receipt of the Society's letter of the 6th of March, and informing that a copy of it was forwarded to his Excellency the Governor, I. M. Higginson, Esq., to which a favorable answer was received from His Excellency, and accordingly a public meeting was held on the 1st August, and a Meteorological Society was formed. From C. Meldrum, Esq, dated 22nd August, 1851, acquainting of the arrival of the instruments per "Teazer," from Bombay, and presenting his best thanks to the Society for their present of the last four numbers of their Transactions. From Captain R. Phayre, dated Phoonda Ghaut, 15th September 1851 enclosing a draft for Rupees 15 on account of his subscription for 1850 51. From J. Jamieson, Esq., "Telegraph and Courier" Office, dated 7th October, 1851, forwarding for the information of the Geographical Society, a register of the thermometer kept at Kurrachee from 1st July, 1850, to 30th June, 1851. From J. G. Lumsden, Esq., Secretary to Govt. General Department, No. 3922, dated 7th Oct. 1851, forwarding, by direction of the Rt. Hon'ble the Governor in Council, a copy of a map of Borneo, for the use of the Society. From D. F. McLeod, Esquire, dated Dhurmsala *vid* Kangra, 26th September, 1851, forwarding a Hoondee for Rs. 15, his subscription for 1851.

MAP.—Map of the Island of Borneo. Presented by Government.

METEOROLOGICAL OBSERVATIONS.—From stations of Kamptee, Penang, Cuddapah, Kurnool, Coimbatoor, Secunderabad, St. Thomas's Mount, Guntoor, Tavoy, and Mergui, Garrison of Bellary and Cuddalore, and Civil Dispensary Nellore, for the month of July, 1851. From stations of Bangalore, Mercara, Hurryhur, French Rocks, and Calicut, garrison of Cannanore, and zillah Mangalore, for the month of August, 1851. From Bagdad, for May and June. From the ports of Cuddalore and Coconada, for July, 1851. From Kurrachee, Rajcote, Surat, and Pahlunpoor, for the months of April, May, and June, 1851. From Sattara, for July and August. From Trevandrum, Calcutta, and Belgaum, for the month of July.

The Secretary stated that the Observations from Bagdad were of peculiar value, as being the first that had reached the Society from this quarter: it was to be regretted that Dr. Hyslop had not been provided with a good barometer in place of an aneroid, and that the hours of 10 and 4 had not been adopted as those of the barostice, which they would, in all likelihood be found to be, in place of 9 and 3; or that a few observations had not been taken to test the question. As they were, however, the observations were of much interest The aneroid gave the latitude of Bagdad about 1200 feet:—the daily range was extremely small, and not very regular.

The mean range of the aneroid for May and June in Bagdad, lat. 33° 17′ 40″, long. 44° 25′, was as follows:—

	6 a. m.	9 a. m.	noon.	3 p. m.	6 p. m.
May.....	28·764	28·798	28·801	28·770	28·756
June.....	28·653	28·688	28·670	28·656	18·599

The mean of May made the barometer higher at noon than at 9 o'clock;—the range betwixt 9 and 3 was no more than ·028—that for June was ·032. In both cases the mercury was lower at 6 than at 3 p. m.; in India it was always higher. Our northernmost barometer stations in India are but little to the south of this,—yet the tides obey the sub-tropical law with the utmost regularity.

No. 1.—Taken from manuscript hourly observations.

No. 2.—From printed observations as taken at 5h. 40m. A. M., 3h. 40m. P. M., and hourly on the 21st of each month, under the direction of T. G. Taylor, Astronomer, Madras.

No. 3.—From printed observations as taken at 9 30—10—10.30 A. M., 3—3—30—4 P. M., 9.30—10—10.30 P. M., and hourly four times each month, by Mr. Mayes.

No. 4.—From printed hourly observations, by T G. Taylor, Astronomer, Madras.

No. 5.—From manuscript observations at 10 A. M., and 4 P. M., by Surgeon B. S. Chinenn.

No. 6.—From manuscript observations at 9.30 A. M., 3.50 P. M., and 9.30 P. M., under the direction of Major L. G. Jacob.

No. 7.—From manuscript observations at 10 A. M., and 4 P. M., by Asst. Surg. T. Fletcher.

No. 8.—From published observations by Lieutenant Colonel W. H. Sykes.

No. 9.—From printed hourly observations by Dr. G. Buist.

No. 10.—From printed observations from the Surveyor General's office, Calcutta. [Ford.

No. 11 and 12.—From manuscript observations at 9 30 A. M., and 3.30 P. M., by Asst. Sur.

No. 13.—From the Bengal Asiatic Society's Transactions.

No. 14.—Manuscript observations at sun rise 10 A. M., 4 P. M., and 10 P. M., by Dr. Don.

No. 15.—From the Bengal Asiatic Society's Transactions.

No. 16.—Manuscript observations as received through Colonel Sleeman from His Majesty the King of Oude's Observatory.

No. 17.—From manuscript observations from Mr. Pyle.

No. 18.—From the Bengal Asiatic Society's Transactions.

19. Ditto Ditto.

20. Ditto Ditto.

21. Ditto Ditto.

No. 22, 23, 24, and 25.—From printed hourly observations, edited by Lieut. Col. Sabine.

From these it will be seen that the barometer north of the line is invariably highest near the winter, and lowest near the summer, solstice,—and this without any reference whatever to the occurrence of the wet season or fall of rain at all: it holds equally at Bombay when our rains are at their height as at Madras in the middle of the dry season; at Aden and Kurrachee, almost rainless stations, as at Calcutta or Lucknow. As a general rule, the annual range encreases, and the amount of daily tide decreases, as we recede from the equator; Adea and Toronto affording the most notable exceptions to this. At Trevandrum and Bombay, in Western India, the daily range, as well as the mean height of the mercury, is least in June. At Kurrachee, the range seems nearly uniform throughout the year: at Madras, Aden, Lucknow, and Futtyghur, the range is greatest when the mercurial column is lowest,—so we have something besides latitude and longitude to deal with, though we cannot tell what it is. The accuracy of all the observations here discussed may be fully depended on: alas! that we should have so few on which reliance can be placed.

On receiving a collection of Mr. Pyle's observations through Dr. Spilsbury in May last, they seemed so interesting that they were forwarded immediately to Colonel Sykes, who laid them before the British Association at Ipswich, as having an important bearing on some of the doctrines on hygrometry.

Some very valuable barometric observations, made by Mr. Pyle, at Fyttyghur, and by Captain Barker, all the way from Bombay to Suez Roads and back, were exhibited. Captain Barker gave all the four turning-points, but had made his morning barostice at 9 in place of 10 o'clock his afternoon at 3 in place of 4; so that a rigid comparison with other observations could not be made. The Futtyghur observations bore all the characteristics of perfect truthfulness.

Mean of 23 days in Suez Roads, from 20th September to 14th October, 1851, corrected for temperature. Latitude, 29° 57′. Longitude, 32° 29′.

	3 a. m.	9 a. m.	3 p. m.	9 p. m.
	29. 95.	30. 02.	29. 93.	29. 98.
Range,	+. 07.	—. 09.	+. 05.	

These were taken by one of the marine barometers first sent out by Mr. Adie, which, though in other respects a very beautiful instrument, did not read lower than hundredths of an inch. The range at Suez would appear to be little over half that at Futtyghur only two degrees further south; but then, when we find the mean altitude of the mercury in close accordance with that of the Colaba Observatory, our faith in the whole concern was shaken by finding the range at Aden, as well as at Bombay, little more than half what we know it actually to be from the registers of the observations at these stations respectively. Sir Henry Lawrence had recently expressed anxiety to assist in such researches, and it was hoped that through this means perfectly accurate observations might speedily be had from Lahore, Mooltan, and Peshawur. The observations expected from Mr. George, at Muscat and Zanzibar, had not yet been received,—a circumstance the more to be regretted inasmuch as the extraordinary anomalies at St. Helena made it most desirable to have as many observations as nearly under the line as possible. St. Helena is in Lat. 5° 40′ 31″ S., their midsummer being our midwinter. Here the great law holds, and the barometer is lowest in December and highest in June.

St. Helena.

June and December.

Max.	Min.	Mean.	Daily Tide.	Yearly Range	Lat. S.	Long. W.
28.352	28.286	28.319	.066	.154	15°56′41″	5°40′31″5
28.268	.198	28.233	.070			

HOBART TOWN, VAN DIEMEN'S LAND.

June and December.

29.686	29.626	29.656	.068	Lat. S.	Long. E.	
29.853	.781	29.817	·072 227	42°52′5″	147°27′5″	105 feet

Here it will be seen that both the daily and yearly ranges decrease to a mere fraction of those at corresponding parallels of northern latitude. At Lat. 30° N. and Lat. 31° 2′ N., at an altitude of 1800 feet, with a barometer at 15 inches, Lieut. Strachey found the tides as regular as they are in the plains of Hindoostan—.057 to .043—say .050— if we may assume the tide throughout the year to be about one-three-hundredth part of the length of the mercurial column, say at Bombay, which it nearly is, we should have the range at this high latitude reduced to the level of the sea above a tenth of an inch, or greater than it is in August in any of the stations enumerated. By the time we reach Toronto, ~~U. S.~~, Lat. 43 °, all these laws have either broken down, or become so masked by constant irregularities, that they are only discovered in masses of means—as it is equally at Hobart Town Lat. 42 ° S., though in these as in all cases, indeed, it is traceable through a sufficiency of mean observations. In a matter of so much interest and mystery, the great thing is to get a sufficiency of observations to ascertain the rule followed by the facts—these furnishing the only means of obtaining an explanation of the cause. It is sad to think that so much time, money, and labour, should be thrown away in pursuing the system usually adopted by the local governments of India, where everything must be done in accordance with form, and which, if form be attended to, nothing more is looked for. There are at present a vast number of observations being made all over the country under the authority of Government: from the returns occasionally received by the Society there cannot be the slightest doubt that in nine-tenths of cases the time and money so employed is thrown away; there are no means of sufficiently instructing or superintending the observers, excepting through the direct instrumentality of meteorologists—no books or manuals of instruction will, in India at all events, suffice. The number of meteorologists amongst us is marvellously small, and none of them are ever consulted.

Dr. Buist laid before the meeting a paper on the volcanoes and volcanic regions betwixt the eastern shore of the Bay of Bengal and Gibbel-Tier in the Red Sea, betwixt the parallels of 10° and 26° N. It will be found amongst the papers.

THE Ordinary Monthly Meeting of the Geographical Society took place in their rooms, on Thursday, the 13th November,—Captain Estridge in the Chair.

Present,—Captain Griffith Jenkins, I. N.; Manockjee Cursetjee, Esq; Dr. G. Buist, and Professor Patton, Secretaries.

The minutes of last meeting were read and confirmed.

The maps, charts, and reports, forwarded by Lieutenant Maury, from the National Observatory, Washington, were laid on the table, and greatly admired by the members present.

In referring to the mode of determining submarine currents still practised, as described in the Washington Report—that of lowering a heavy kettle or a gigantic log to the depth required, and then making it fast to a float on the surface,—Dr Buist described his improved current measuring instrument, which promised to fulfil the ends required in a manner more worthy of the present state of science. It had, with the instrument described in the last year's number of the Transactions, been found so difficult to exclude the sea water from the compass at very great depths, that it was considered more expedient to admit it at once, protecting the needle, if necessary, from rust by varnish or electrotype gilding: this had been found to answer perfectly, and enabled the instrument to be very greatly lightened and simplified, the original principle of construction being retained. The velocity of the current was determined by a little fly, like that

of a patent log or window ventilator, and the instruments, which had been carefully tried at moderate depths, and seemed to answer to perfection, could in this fashion be made up for betwixt Rs. 25 and Rs. 30; a minute description of it, with a drawing, will appear in next number of the Transactions. Parties desiring o be provided, can be so through the Secretary to the Society.

The following is a list of the letters, &c., laid on the table of the Society:

LETTERS.

From J. G. Lumsden, Esquire, Secretary to Government, Marine Department, No. 963, dated 11th October, acknowledging the receipt of the Society's letter No. 50, of 22nd September, and in reply stating that the Right Hon'ble the Governor in Council approves of the arrangements therein proposed in reference to the establishment of self-registering wind and rain gauges at Poona and Nuggur. Also requesting to communicate direct with Captains Studdert and Gaisford on the subject.

From J. G. Lumsden, Esquire, Secretary to Government, Marine Department, No. 1010, dated 23rd October, stating that the Right Hon'ble the Governor in Council considers it will be preferable for the Geographical Society to forward their bills for printing the Meteorological Observations to be disbursed after the work is completed.

From H. B. E. Frere, Esq., Commissioner in Scinde, No. 2198, dated 18th October, enclosing copies of a report and rules agreed on at a meeting of subscribers to a project for establishing a public general library at Kurrachee. Also requesting a copy of the Society's Transactions for the use of that library, and any other support that the Society may be, from time to time, able to afford them in their enterprise.

From C. Meldrum, Esquire, Royal College, Mauritius, dated 22nd September, transmitting an order on Messrs. Barnett, Hoares, and Co., for £14, on account of instruments purchased by him from the Society.

From J. S. Law, Esquire, Collector of Dharwar, dated 18th October, informing of his having remitted through the Civil Pay Office, Rs. 37, due by him on account of instruments.

From Lieut. Fergusson, I. N., Superintendent of the Observatory at Colaba, dated 25th October, forwarding a copy of the Washington Astronomical Observations of 1846, received from the Royal Society for presentation to the Bombay Geographical Society.

From John Connon, Esquire, Secretary to the Chamber of Commerce, dated 27th October, forwarding for presentation to the Geographical Society a copy of their last year's report.

From Lieut. Fergusson, I. N., Superintendent of the Observatory at Colaba, dated 14th November, acknowledging the receipt of the Secretary's letter No. 67, with 3 sets of Lieut. Maury's Wind and Current charts for Captain Montriou, and requesting to be informed whether any books accompanied them.

From Captain J. Willoughby, dated Paunch-Gunny, 4th November, informing of his having remitted this month through the Military Pay Office Rs. 42 for a bound set of the Society's Transactions.

From Dr. C. Collier, Neemuch, dated 6th November, informing of his intention to remit Rs. 12 through the Military Pay Office on the 1st December.

CHARTS.

Wind and Current Charts of the North and South Atlantic Ocean, 18 sheets. By Lieutenant

M. F. Maury, Superintendent of the National Observatory at Washington. Presented by the author.

BOOKS.

1. Washington's Astronomical Observations of 1846. Presented by the Royal Society of London.

2. Report of the Bombay Chamber of Commerce for the year 1850-51. Presented by the Chamber.

3. The Journal of the Indian Archipelago and Eastern Asia, No. 8, for the month of August. 1851. Presented by Government.

4. The Second General Report of the Dekhan Vernacular Translation Society from the 13th February, 1850, to the 31st July, 1851. Presented by the Society.

5. Notice to Mariners, by Lieutenant M. F. Maury, U. S. N., approved by the Hon'ble William B. Preston, Secretary of the Navy. Presented by the author.

6. Paper on the Gulf Stream and Currents of the Sea. By M. F. Maury, Lieutenant, U. S. N.

7. On the probable relation between magnetism and the circulation of the atmosphere.

METEOROLOGICAL OBSERVATIONS.

(*By Government.*)

From Calcutta and Belgaum, for the months of August and September, 1851.

From the Ports of Cuddalore and Coconada, for the month of August, 1851.

From Sattara for the month of September, 1851.

From Ahmedabad, Rajcote, Bhooj, Alibaugh, Dharwar, Broach, and Civil Hospital Kolapoor, for the month of July, August, and September, 1851.

From stations of Cuddalore, Guntoor, Chittoor, Ponany, Madura, Cuddapah, Cochin, Kamptee, Coimbatoor, Secunderabad, Kurnool, Trichinopoly, Nellore, Palamcotta, Bellary, and Saint Thomas's Mount, for August, 1851.

Supplementary remarks on the Meteorology of Scinde during the past year, by Dr. J. Don.

Meteorological Register kept at the Vizagapatam Observatory for the months of July, August, and September, 1851. By G. V. Juggarow, Esq., Presented by the author.

ADEN DIP OBSERVATIONS.

The following observations for inclination were taken with a dipping circle by Robinson, six inches in diameter. It is supported on three screw feet, by which an azimuth circle, divided to single degrees, is levelled. This again is read off by pointers easily read to one-tenth of a degree, and the pointers are at the extremities of arms fixed to a brass pillar that can be moved in azimuth and support. The vertical or dip circle which supports the agate planes on which the axle of the needle revolves, is divided into fifteen minutes. The instrument is provided with four new needles from Robinson, the maker, to whom it was in 1849 sent for repairs, and it is in first rate order. Each determination is taken in the usual way with sixteen readings after the needle has become at rest.

The observations are entered as follow :—

(In column A.) The observations are taken with north pole at the marked end A., and with the face of the needle on the same side as the face of the dip circle, and with the face of the dip circle towards the E.

(In column A′) The same, but with the face of the dip circle towards the West.

(In column A″) With the north pole at which is the same end, but with the face of the needle on the contrary side to the face of the dip circle towards the East.

(In column A‴) The same but with the dip circle towards the West.

And the other columns denote similar relative position of the needle when the north pole is at the marked end B.

When there are two sets of observations on the same date, the first is taken at 8 A. M., and the last at 4 P. M; but when there is only one set it is taken at 8 A. M.

February, 1850.	No. of Needle.	Poles Direct.				Poles Inverted.				Means	Inclination.		Monthly Means
		Face of Needle.				Face of Needle.					A. M.	P. M.	
		Direct.		Reversed.		Direct.		Reversed.					
		A	A′	A″	A‴	B	B′	B″	B‴				
Date.	No.	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′ ″			
1	1	5·45	3·50	4·50	4 07	5·15	3·45	5·00	3·50	4·32·45			
1	1	5·15	3·45	5·30	3·40	5·23	4·00	4·45	4·30	4·36·00			
2	2	7·45	6·15	7·50	6·15	2·30	1·40	2·00	0·45	4·22·30			
2	2	7·07	8 15	8·30	8·00	2·37	0·40	2·37	0·45	4·48·52			
3	3	4·45	3·00	4·45	2·45	5·15	4·15	5·30	3·40	4·14·22			
3	3	4·30	3·15	3·45	3·00	6·05	4 30	5·40	5·15	4·30·00			
4	4	5·23	4·45	5·15	3·50	4·01	4·00	4 37	3·45	4·27·45			
5	1	5·30	3·37	5·37	3·37	5·00	3·05	5·15	4·00	4·33·15			
5	1	8·00	7 15	8·30	6·30	1·45	1 37	3·00	1·00	4·38·22			
6	2	8·00	7·15	8·00	6·30	1·45	1·37	3·00	1·00	4·38·22			
6	2	8 07	7·15	8 45	7·00	1·45	0·30	2·30	1·00	4·36·30			
7	3	4·30	3 30	4·37	3·30	4·45	4·00	5·30	4·00	4·17·45			
7	3	4·45	3·23	5·07	3·15	5·45	4·30	5·30	4·30	4·35·37			
8	4	5·00	4·00	5·00	3·45	5·15	3·15	4·45	4·00	4·22·30			
8	4	5·25	4·00	5·45	3·15	6·00	4·07	5·07	3·50	4·33 22			
9	1	5·30	4·00	5·15	4·00	5·15	4 47	4·45	4·00	4·41·30			
9	1	5·30	4·15	5 45	4·15	5·30	3·45	5·15	3·15	4·41·15			
11	3	5·15	2·37	4·00	2·37	6·15	4·45	5·35	4·45	4·38·37	° ′ ″	° ′ ″	° ′ ″
12	4	5·30	4·30	5·00	4·15	5·30	3·45	4·30	4·00	4·37·30	4·33·06	4·36·15	4 34·41
12	4	5·15	4·00	5·07	4·15	6·27	4·00	5·45	3·30	4·47·22			
13	1	5·07	4·30	5·37	5·15	4·45	3·50	5 00	3·15	4·39·52			
13	1	5·50	4·30	5·30	4·00	4·35	3·50	4·15	3·30	4 30·00			
14	3	4·50	3·30	4·35	3·15	5·15	4·00	5·30	4.30	4·33·07			
18	1	5 15	4·00	5·23	4·00	5·00	4·00	5·45	3·45	4·35·30			
18	1	5·15	4·30	6 00	3·45	4·15	4·15	5·00	3·37	4·38·22			
19	2	7·00	6·15	7·30	6·05	2·07	2·20	0·40	0·50	4·38·22			
19	2	8·00	7·05	8·30	7·05	7·07	1·15	2·00	0·30	4·26·30			
20	3	5·48	3·00	4·52	3·15	5·37	4·22	5·37	3·15	4·28·15			
20	3	5·35	3·50	5·00	3·37	6·45	4·00	4·45	4·07	4·42·22			
21	4	6·15	3·30	5·22	4·15	5·15	3·07	4·52	4·00	4·34·30			
21	4	5·25	4·00	5·00	4·45	5·20	4·00	4·37	4·15	4 39·52			
22	1	5·35	4·45	5·45	3·37	4·37	3·45	5·07	3·45	4·37·00			
22	1	5·15	4·30	4·00	5·00	5·20	4·20	5·45	4·00	4·46·00			
23	2	7·15	6·50	8·40	6·20	2 07	1·30	2·30	1·00	4 31·30			
23	2	8·07	6·37	8·10	8·07	1·55	1·37	1·55	1·07	4·41·52			
25	3	5·23	3·37	5·00	3·15	5·45	4·00	5·07	3·50	4·29·37			
25	3	4·15	3·30	5 00	3·00	5·37	5·00	5·30	4·00	4·29·00			
26	4	5·22	4 30	5·45	3·52	4·45	4·20	5·07	3·45	4·40·45			
26	4	4·50	3·45	4·45	5·00	5·15	3·00	5·07	4·07	4·28·27			
27	1	5·30	4·00	5·52	4·30	5·00	3·23	5·00	3 15	4·33·45			
27	1	5·23	4·07	5·00	4·53	5·52	4·22	5·00	3·52	4·48·37			
28													
28													

March, 1850.	No. of Needle.	Poles Direct or A. End. Face of Needle. Direct. A	A′	Reversed. A″	A‴	Poles Inverted or B. End. Face of Needle. Direct. B	B′	Reversed. B	B‴	Means.	Inclination. A. M.	P. M.
Date.	No.	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		
1	1	5·07	3·52	4·45	4·00	5·15	4·15	5·00	3·45	4·29·52		
1	1	4·52	4·30	5·30	3·52	5·00	4·45	5·30	4·00	4·44·52		
4	2	8·21	6·45	8·07	6·30	2·00	1·46	2·52	1·52	4·46·57		
4	2	8·07	7·00	7·45	6·45	2·22	1·45	2·45	1.30	4·44·52		
6	3	5·07	3·00	4·45	3·45	5·45	4·30	5·30	3·45	4·30·52		
6	3	4·30	3·00	4·52	3·00	4·30	4·52	5·45	3·45	4·12·07		
8	4	5·15	3·15	5·07	4·00	5·00	3·15	5·00	3·30	4·17·45		
8	4	4·45	4·45	5·00	3·30	4·52	4·45	4·30	3·15	4·25·15		
10	1	5·00	4·15	5·00	3·37	5·30	4·60	4·45	3·45	4·29·00		
10	1	4·42	4·15	4·15	3·30	5·30	4·15	5·30	3·45	4·27·45		
13	2	8·21	6·46	8·07	7·15	1·30	1·21	2·30	1·15	4·38·00	° ′ ″	° ′ ″
13	2	8·07	7·07	8·00	6·30	2·52	1·45	2·45	1·37	4·50·22	4.30·37	4·32·53
15	3	5·07	3·15	4·30	3·52	5·15	4·45	5·30	4·00	4·31·45		
15	3	5·07	3·15	4·45	3·15	4·52	4·45	5·45	3·45	4·26·07		
18	2	8·07	7·22	8·15	7·22	1·45	0·45	2·00	0·45	4·32·37		
18	2	8·15	7·30	8·30	7·00	2·15	0·45	1·45	0·37	4·34·37		
20	1	4·30	4·07	5·00	4·00	5·15	4·15	5·22	4·30	4·32·22		
20	1	4·42	3·45	4·15	4·00	5·30	4·07	5·22	4·00	4·38·07		
22	4	5·15	3·15	5·07	3·15	5·07	3·30	5·15	3·45	4·18·37		
22	4	5·00	4·00	4·52	3·45	4·30	2·30	4·52	5·00	4·18·37		
25	3	5·00	3·07	4·30	4·00	5·30	4·45	5·30	4·00	4·32·45		
25	3	5·00	3·52	4·30	3·30	5·07	4 45	5·30	4·30	4·35·30		
27	4	5·15	4·07	4·15	3·00	5·30	4·00	5·00	3·30	4·19·37		
27	4	5·15	4·00	4·45	3·15	5·00	4·30	4·45	4.00	4·26·15		
29	1	5·30	3·37	6·00	3·45	5·37	3·45	5·07	4·45	4·38.15		
29	1	4·45	4·15	5·30	4·45	5·07	5·45	5·37	3·00	4·43·00		

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Mean of the Month.... 4·31·45

May, 1850.	No. of Needle.	Poles Direct or A. End.				Poles Inverted or B. End.				Means.	Inclination.	
		Face of Needle.				Face of Needle.					A. M.	P. M.
		Direct.		Reversed.		Direct.		Reversed.				
		A	A′	A″	A‴	B	B′	B	B‴			
Date.	No.	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		
1	4	5·15	4·15	5·15	4·00	5·00	3·45	5·00	3·45	4·31·52		
1	4	5·15	3·45	5·15	3·52	5·15	4·30	5·30	4·00	4·40·15		
3	1	5·15	4·00	5·00	3·45	2·00	4·00	5·15	3·45	4·37·30		
3	1	5·07	4·15	4·45	3·15	5·45	4·45	5·30	3·30	4·36·30		
6	3	5·00	3·30	5·00	3·07	5·30	4·00	5·00	3·52	4·22·22		
6	3	5·00	3·45	5·15	3·30	4·30	4·30	5·30	4·00	4·30·00		
8	4	5·45	3·30	5·30	4·00	5·15	3·30	5·22	4·45	4·42·09		
8	4	5·30	3·45	5·15	3·45	5·07	4·45	5·00	3·30	4·34·37		
10	1	5·00	4·07	5·00	3·45	5·15	4·30	5·15	3·52	4·35·30		
10	1	5·30	4·00	5·15	4·37	5·07	4·30	5·15	4·15	4·48·37		
13	3	5·15	3·30	5·00	3·00	5·45	4·15	5·00	4·07	4·32·45		
13	3	4·45	3·30	4·45	3·15	5·30	5·45	5·15	4·00	4·20·37		
15	4	5·15	3·37	4·30	4·30	5·00	3·52	5·40	3·30	4·18·00		
15	4	5·15	4·00	5·30	3·22	5·07	3·45	5·00	4·00	4·29·52		
17	1	5·00	4·07	5·00	3·45	5·15	4·30	5·15	3·52	4·35·30	° ′ ″ 4.32·52	° ′ ″ 4·35·16
17	1	5·30	4·00	5·15	4·35	5·07	4·30	5·15	4·15	4·48·37		
20	3	5·00	3·30	5·00	3·07	5·30	4·00	5·00	3.52	4·22·22		
20	3	5·00	3·45	5·15	3·30	4·30	4·30	5·30	4·30	4·30·00		
22	4	5·45	3·45	5·15	4·07	5·07	3·22	5·15	4·45	4·40·07		
22	4	5·15	3·45	4·52	3·30	5·07	4·30	5·00	3·30	4·26·27		
24	1	5·15	4.15	5·15	4·00	4·30	3·30	5·00	3·15	4·22·30		
24	1	5·15	3·30	5·00	3·30	5·18	3·52	5·37	3·45	4·28·00		
27	3	4·15	3·00	5·30	4·45	5·45	4·00	5·30	4·15	4·37·30		
27	3	4·15	5·07	3·15	4·30	5·22	4·30	3·45	5·30	4·39·15		
29	4	5·30	3·45	5·45	4·15	5·15	4·00	4·45	4·00	4·39·22		
29	4	5·15	4·07	5·15	3·45	5·00	3·45	5·15	4·15	4·34·37		
31	1	5·45	4·15	5·30	4·45	5·15	3·07	5·30	3·30	4·42·00		
31	1	5·45	4·30	5·30	4·45	5·15	3·15	5·30	3·45	4·46·52		
											° ′ ″	
										Monthly Mean....	4·34·02	

Poles Reversed.

Face East.

End B Veberated.								End A Veberated.							
	°	′		°	′	°	′ ″		°	′		°	′	°	′ ″
—	29	45 }	+	19	00	4	56		30	45 }	+	20	45	4	33
—	28	00 }							29	00 }					
—	26	13	+	17	15	4	56		27	00	+	19	07	4	27
—	24	30	+	15	30	4	55		25	15	+	17	00	4	33
—	22	52	+	13	45	4	58		23	30	+	15	15	4	33
—	21	15	+	12	15	4	45		21	45	+	13	45	4	26
						Mean.....	4 55 48							Mean.....	4 30 24

Face West.

	°	′		°	′	°	′ ″		°	′		°	′	°	′ ″
—	30	30 }	+	20	45	4	26		29	45 }	+	18	30	5	09
—	28	45 }							27	52 }					
—	27	00	+	19	00	4	26		26	00	+	16	30	5	13
—	25	00	+	17	15	4	22		24	15	+	14	45	5	11
—	23	15	+	15	30	4	18		22	30	+	13	00	5	11
—	21	45	+	14	00	4	15		20	45	+	11	15	5	16
						Mean.....	4 21 26							Mean.....	5 12 00

Axle Reversed.

Face East.

	°	′		°	′	°	′ ″		°	′		°	′	°	′ ″
—	29	45 }	+	18	45	4	56		29	45 }	+	19	45	4	33
—	27	30 }							28	00 }					
—	25	15	+	17	00	4	41		26	15	+	17	45	4	41
	23	00	+	15	15	4	41		24	15	+	15	00	4	37
	21	15	+	13	30	4	18		22	30	+	14	00	4	30
	19	45	+	11	45	4	22		21	00	+	12	38	4	33
						Mean.....	4 35 26							Mean.....	4 34 12

Face West.

	°	′		°	′	°	′ ″		°	′		°	′	°	′ ″
—	30	15 }	+	19	45	4	48		30	30 }	+	19	45	4	46
	28	30 }							28	15 }					
	26	30	+	18	07	4	47		26	15	+	18	00	4	36
	25	15	+	16	30	4	46		24	45	+	16	15	4	36
	23	15	+	14	45	4	52		23	00	+	14	45	4	33
	22	15	+	13	15	4	50		21	30	+	13	00	4	37
						Mean.....	4 48 34							Mean.....	4 37 34

In this way five or six readings were generally obtained in each of the several eight positions of the needle thus in the case just cited the whole of the readings when reduced are as follows:—

	End A.			End B.		
	°	′	″	°	′	″
Face of Inst. East axis direct.	4	57	48	4	45	24
.. .. West	4	40	12	4	36	48
.. .. East .. .. Inverted.	4	21	12	4	47	26
.. .. West	4	21	36	4	32	00
Reversed the Rolls.						
Face of Inst. East axis direct.	4	55	48	4	30	24
.. .. West	4	21	26	5	12	00
.. .. East .. .. Inverted.	4	35	26	4	34	12
.. .. West	4	48	34	4	37	34
Mean..	4	37	45	4	41	58

° ′ ″

The True dip. 8= 4 39 51

THE Ordinary Monthly Meeting of the Bombay Geographical Society was held in its Rooms, Town Hall, on Thursday the 8th January 1852.

PRESENT.

John Smith, Esquire, in the Chair.

P. W. LeGeyt, Esq ; R. Haines, Esq., M. B.; Capt. G. Jenkins, I. N.; Venayakrow Jagonathjee, Esq. ; and Professor Patton, Secretary.

The Minutes of the Meeting, held on the 13th November 1851, were read and confirmed.

MEMBER PROPOSED.—A. Remington, Esq., by the Secretary, seconded by P. W. LeGeyt, Esquire.

Proposed by John Smith, Esquire, seconded by P. W. LeGeyt, Esq., and carried :—

Resolved,—" That Arrowsmith's new map of recent Aretic Discoveries in search of Sir John Franklin, and Arrowsmith's map of Gold Fields in Australia and California be ordered out from England ; and generally any new maps of interest regularly as published."

LETTERS READ.

No. 1158 of 1851, from Colonel Melville, Secretary to Government, Marine Department; Nos. 9700 and 10297 of 1851, from Lieutenant W. F. Marriott, Secretary to the Military Board; and letters from Captain Becher of the Admiralty, Messrs. Adie and Sons, Captain Gribble, J. Power, Esquire ; W. E. Frere, Esquire; Captain Gaisford, and John Peet, Esquire, Secretary Medical and Physical Society, Bombay.

PRESENTS TO THE LIBRARY.

1. Journal of the Indian Archipelago and Eastern Asia, for June, July, and September. Presented by Government.

2. Journal of the Royal Geographical Society of London, Vol. xx Part ii.

3. Bulletin De La Societe De Geographie, Troisieme Serie Tome xiv.

4. The Trial of Lalla Jotee Pershad and others. Presented by the Government of India.

5. Transactions of the Medical and Physical Society of Bombay, No. X. Presented by the Society.

6. Meteorological Observations made at the Cape of Good Hope under the Superintendence of Lieut. Col. Sabine. Presented by H. M.'s Government.

7. The General Distance Tables, by Capt. Gribble. Presented by the Author.

8. The Track of the West India Hurricane of 1851, Sir W. Reid. Presented by Geo. Buist, Esq., L. L. D.

METEOROLOGICAL OBSERVATIONS.

From Trevandrum, for August, September, October and November 1851.

From Pahlunpoor, Surat, and Sawunt Waree, for July, August and September 1851.

From Calcutta and Sattara, for October and November 1851.

From the Ports of Cuddalore and Coconada, for September, October and November.

From Stations of Kamptee, Secunderabad, Calicut, Coimbatoor, Cuddapa, Kurnool, Madura, Chittoor, Nellore, Guntoor, Bangalore, Hurryhur, Mercara, French Rocks, Pallamcotta, Trichinopoly and Cochin, Garrisons of Bellary and Cannanore, Cantonment of St. Thomas's Mount, and Zillah Mangalore, for the months of September and October 1851.

From Belgaum, for the month of November,

From the stations of Cuddalore and Penang, for September,

From Bagdad, for July and August.

From Muscat, for June, July, August and September.

From Vizagapatam, for October.

After voting their best thanks to the several gentlemen, for their very valuable presents to the Library, the Meeting adjourned.

THE Bombay Geographical Society held its Ordinary Monthly Meeting on the 12th Feb.: present,—Commander G. Jenkins, I. N., senior member, in the chair; Mr. Malet, Secretary to Government; Mr. J. Smith, merchant; Lieut E. F. T. Fergusson, I. N., in charge of Observatory; Mr. N. Oliver, Assistant Master-Attendant; R. Haines, Esq., M. B.; Venayekrao Jugonnathjee, Esq.; and Dr. G. Buist and Professor J. Patton, Secretaries. The minutes of last meeting were read and approved of. The motion of Mr. Smith, brought before last meeting, on the subject of recent maps and charts, including the newest information in the Polar Seas and around California, was considered a notice, and the motion was put and agreed to. Mr. Smith gave notice of a motion for the purchase of the Blue Books of 1848 and 1851, published by the Admiralty, on the subjects of Polar discovery; and the Secretary stated that although in point of form this must be put at next meeting, he would venture, on his own responsibility, on including the two orders in one, trusting to the motion being agreed to next meeting: a month would thus be saved—Mr. Remington was unanimously elected a member of the Society.

The papers of Dr. Buist on the Volcanoes of India, formerly laid before the Society and referred to the Committee on papers,—with the one on the Geology of Bombay,—recommended by the Committee to the Society, were directed to be published. Dr. Buist laid before the meeting a box of specimens illustrative of the Geology of Bombay, and stated that a number of similar boxes had been made up for the service of those desiring them. They were kept within such size that two of them might be carried on a bullock, or one transported on the head of a coolie. They were each divided into twenty-eight compartments, each compartment containing one or more specimens carefully packed and labelled. The paper before them would form a companion for the boxes for Bombay. An officer proceeding to Scinde, Kolapore, or the Deccan, might provide himself with a box of the specimens belonging to the locality, which would thus furnish him with a key to the rocks in the neighbourhood: and so with any other quarter to which he might propose proceeding. No man could carry with him a complete suite of geological specimens for the purposes of research—those of the district were enough. The collections were specially intended for the Indian Navy, the Quarter-Master-General's and Revenue Departments or any other, the officers under which were engaged in survey or out-of-door work. They were made up at the School of Industry, and supplied at five Rupees each; box and specimens included,—thus allowing a small profit to the charity.

Mr. Patton laid before the Society some interesting observations on the moisture contained in the atmosphere under different pressures and temperatures, especially in relation to the formulæ of Apjohn, Dove, and Glaisher, by which the fact was ascertained.

Dr. Buist made some remarks on the remarkable elevation of the Barometer all over India in the end of January and beginning of February, which seemed to occur near the change of the moon. This had been observed continually over a period of eight years at Calcutta, Madras, and Bombay, Trevandrum and Lucknow—at all the stations, in fact, where good observations were obtained. It was near the period of greatest cold, but not at all coincident with it: it occurred very often about the time of the fall of rain, and at all the points just named almost simultaneosly; the mercury springing up by nearly a-tenth of an inch, and then descending as suddenly as it rose. A large mass of figure tables and diagrams were placed before the Society on the subject.

TABLES, SHOWING THE GREAT FEBRUARY RISE OF THE BAROMETER AT CALCUTTA, MADRAS, ADEN, BOMBAY, AND KURRACHEE.—The figures on the left hand side of the table indicate the days of the month—the columns for January and February are placed immediately contiguous to each other. The columns of the readings commence in the former of these months, when the mercury first begins steadily to rise, and is continued through the second, till the wave has passed. The observations are all corrected for temperature and taken from the records of the observations at the various places named—their accuracy may be depended on. It is unfortunate that we have so few years of contemporaneous observation for the purpose of comparison. So far as it appears, the maximum of the Barometer occurs all over India at very nearly the period of greatest cold, and when the air is dryest: the tables do not enable us to trace anything like a fluctuation from point to point. On all occasions, it will be observed, the ascents and descents are both rapid, and the mercury having reached its highest point, begins to fall again immediately. It not unfrequently happens that there are two of these sudden jumps upward to nearly the same elevation, and at no great distance in point of time from each other. The publication of the Simla, Lucknow, Singapore, and Trevandrum, and the continuation of the Madras observations will, most likely, furnish us with a large additional amount of light—all, perhaps, that may be required to establish the law, and commence the examination of its origin and cause. The following is an abstract of the Tables:—

	CALCUTTA.	MADRAS.	BOMBAY.	ADEN.	KURRACHEE.	SAWUNT WARREE.
1841	21 Feb. 30·084	... ...	... ...	... ...	... ...	... ...
1842	10 Feb. 30·033	9 Feb. 30·028	... ...	... ...	... ...	... ...
1843	25 Jan. 30·077	23 Jan. 30·153	24 Jan. 30·080	... ...	... ...	... ...
1844	17 Jan. 30·085	14 Feb. 30·037	12 Jan. 30·032	... ...	... ...	... ...
1845	11 Jan. 30·302	11 Jan. 30·116	12 Jan. 30·055	... ...	... ...	... ...
1846	... ...	... ...	6 Jan. 30·104	... ...	... ...	... ...
1847	5 Feb. 30·090	... ...	1 Jan. 30·017	8 Feb. 29·907	... ...	... ...
1848	8 Feb. 30·126	... ...	... ...	3 Feb. 29·961	... ...	... ...
1849	5 Feb. 30·089	... ...	... ...	3 Feb. 29·978	... ...	... ...
1850	4 Feb. 30·158	... ...	... ...	24 Feb. 29·871	... ...	20 Feb. 29·675
1851	... ...	... ...	... ...	... ...	21 Jan. 30·014	... ...

In 1847, it will be observed, the barometer reached its maximum at Bombay on the 5th February, at Calcutta, 16° to the east, on the 5th, and at Aden, 17° to the west, on the 7th: were the fluctuations due to an atmospheric wave it would almost seem as if this had originated near Bombay and the swell then progressed at an almost equal rate on both sides. This is a particular case and this part of the law does not extend to other years: in 1945, the barometer reached its maximum at Calcutta and Madras on the 11th, and at Bombay on the 12th January, reaching, at the first named of these places, the extraordinary elevation of 30·302, at the others 30·116 and 30·055 respectively.

The tables, as just stated, are so exceedingly imperfect that they are hardly deserving of more minute analysis, and any law that might be deduced from them as they stand would probably be invalidated or upset by a more extended observation: they are given prominently to attract attention to the subject, and as illustrating the variable laws which guide the regular periodical fluctuations of our atmosphere, two or three of which alone are familiar to us.

THE GREAT ATMOSPHERIC TIDE OF THE END OF JANUARY AND BEGINNING OF FEBRUARY, AS OBSERVED AT ADEN, MADRAS, AND BOMBAY, BETWIXT 1840 AND 1850.

	ADEN.								MADRAS.								BOMBAY.					
	1847.		1848.		1849.		1850.		1842.		1843.		1844.		1845.		1845.		1846.		1847.	
Dates.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.
1	...	29·855	...	29·957	...	29·937	...	29·797	...	30.023	...	30·007	...	29·938	30·001	29·931	29·909	...	30 092	29·987	30.017	29 961
2	...	·896	...	·907	...	·956	...	·760	...	·002	...	29·092	...	·939	29·984	...	·912	29·906	·099	30·031	..	30·005
3	...	·844	...	·961	...	·978	...	·802	...	·004	...	·934	...	·979	·996	·954	·928	·946	...	·055	29·971	29·937
4	...	·823	...	·941	...	·928	...	·805	...	29·976	...	·947	...	...	30·014	·954	...	·933	·012	·027	·982	·897
5	...	·803	...	·925	...	·924	...	·851	...	·969	...	...	30·032	...	...	·983	·943	·921	·027	·022	·963	·909
6	...	·832	...	·902	...	·918	...	·828	...	30·023	...	·924	·017	·076	·995	·994	·923	·104	·018	·958	...	
7	...	·891	...	·8·9	...	·872	...	·794	...	·023	...	·937	29·968	·094	·999	30·024	·906	·093	...	·951	.969	
8	...	·907	...	·882	...	·877	...	·809	...	·0·6	...	·966	...	·915	·0·8	30·006	·052	...	·061	29·953	·908	·941
9	...	·896	...	·882	...	·908	...	·841	...	·028	...	·960	...	·949	·074	...	·020	·976	·062	·946	...	·852
10	...	·819	...	·889	...	·956	...	·818	...	·019	...	·959	...	·983	·115	29·974	·042	·913	...	·943	·936	·803
11	...	·774	...	·904	...	·882	...	·780	...	29 986	...	...	...	·983	·116	·998	...	·901	.099	·966	·953	·842
12	...	·778	...	·881	...	·852	...	·789	...	·964	...	...	...	...	...	30·005	·055	·925	·063	·984	·926	·919
13	...	·853	...	·865	...	·889	...	·799	...	·955	...	...	...	·997	·065	·015	29·996	·920	·044	·985	·926	...
14	...	·886	...	·846	...	·940	...	·779	...	·982	...	...	...	30·037	·021	·002	29·944	·900	·065	...	·935	·930
15	...	·834	...	·868	...	·894	29·700	·782	...	·979	...	...	...	·001	·039	29·971	·967	...	·062	30·011	·945	·903
16	...	·834	...	·863	...	·879	·719	·803	...	·978	...	...	...	·032	·053	...	·982	·931	·032	·037	...	·852
17	...	·850	...	·842	...	·888	·766	·811	...	...	29·882	...	...	29·991	·056	·937	·986	·928	...	·017	·978	·868
18	...	·842	...	·828	29·853	·855	·789	·782	...	·959	·955	...	...	·988	·032	·935	...	·891	·057	·002	·958	·905
19	...	·830	...	·801	·884	·785	·777	·819	...	·934	·927	...	...	...	...	·944	·960	·886	·029	·030	926	·917
20	...	·764	...	·796	·914	·786	·760	·836	...	...	30·049	...	...	30·002	...	·923	·935	·847	·068	·027	·894	...
21	...	·760	...	·806	·936	...	·817	·828	...	...	·081	...	...	29·985	29·990	·917	·916	...	·042	...	·891	·903
22	29·723	...	...	·804	·913	...	·793	·750	...	...	·134	...	...	·965	·980	...	·913	·926	·065	29·985	·875	·903
23	·753	...	...	·774	·963	...	·773	·786	...	...	·153	...	...	·966	·980	...	·895	·888	·088	30·045	...	·884
24	·728	...	29·786	·770	·882	...	·792	·871	...	...	·102	...	29·918	...	·978	...	·909	·884	...	·082	·870	·901
25	·706	...	·777	...	·886	...	·826	·868	...	...	·072	...	·892	...	·950	...	·884	·902	·058	·079	·780	·889
26	·668	...	·774	...	·876	...	·820	·826	29·959	...	·037	...	·876	...	...	...	·882	·904	·079	·061	·810	·879
27	·673	...	·804	...	·903	...	·823	·803	·943	...	·034	...	·856	...	·951	...	·897	·891	·090	·060	·879	...
28	·710	...	·801	...	·922	...	·831	·800	·963	...	...	...	...	...	·946	...	91·	...	·049	·074	·851	·909
29	·761		·780		·952		·829		...		·042		·890		·950		894		·018		·874	...
30	·779		·844		·979		·861		·979		·037		·937		·918		·893		29·968		...	...
31	·806		·868		·936		·863		30·005		...		·950		·918		...		...		·883	...

THE GREAT ATMOSPHERIC TIDE OF THE END OF JANUARY AND BEGINNING OF FEBRUARY, AS OBSERVED AT CALCUTTA, BETWIXT 1840 AND 1850.

CALCUTTA.

Dates.	1839.		1840.		1841.		1842.		1843.		1844.		1845.		1847.		1848.		1849.		1850.	
	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.
1	..	30·011	..	29·985	..	..	..	29·988	..	29·933	..	29·934	30·098	29·949	..	29·999	..	29·895	..	30·085	..	29·957
2	..	·045	..	·991	..	..	..	·969	..	·867	..	·951	·094	·955	..	30·022	..	·899	..	·037	..	·999
3	..	·032	..	30·010	..	29·917	..	·960	..	·800	..	·942	·109	·946	..	·e9	..	·949	.	·085	..	30·134
4	..	·004	..	29·990	..	·914	..	·920	..	·796	..	..	·083	·961	..	·082	..	30·010	..	·075	..	·158
5	..	·003	..	·968	..	·968	..	·872	..	·836	29·905	·991	·203	·996	..	·090	..	·007	..	·089	..	·107
6	29·973	..	..	·951	..	·936	..	·902	..	·799	·930	30·028	·269	30·054	..	·069	..	29·987	..	·070	..	·06:
7	30·043	..	..	·887	..	·959	..	·995	..	·741	·874	·043	·243	·063	..	·057	..	·969	..	·073	..	·081
8	·043	..	..	..	..	·964	..	30·002	..	·766	·911	29·988	·172	·060	..	·064	..	30·126	..	·073	..	·140
9	29·947	..	..	..	..	·964	..	·007	..	·770	30 050	·911	·218	·054	..	·034	..	·121	..	·051	..	·143
10	·927	..	..	..	..	·925	..	·033	..	·773	·013	·85	·285	·063	29 996	..	..	·071	..	·014	..	..
11	·885	..	..	..	..	·924	..	29·974	..	·799	·0 8	·922	·302	·015	..	·903	..	·057	..	..	..	..
12	..	..	..	..	..	·938	..	·965	..	·809	·033	·996	·237	·062	..	..	..	·073	.	29·963	..	..
13	..	..	..	..	..	·989	..	·918	..	·833	·073	·969	·156	·032	..	..	..	29 982	..	·881	..	..
14	..	..	..	..	..	30·013	..	·874	..	·820	·044	·965	·121	·049	..	..	..	30·057	..	..	..	29·990
15	..	..	..	..	..	·032	..	·847	..	·824	·061	·985	·173	·015	..	..	..	·118	..	..	..	30·002
16	..	..	..	..	..	·028	..	·835	..	·830	·097	·955	·199	..	..	..	..	·100	..	..	..	29·993
17	..	..	..	..	..	·014	..	..	29·855	·7e9	·085	·929	·179	29·976	..	..	..	29·997	..	..	..	30·008
18	..	..	..	..	..	·068	..	..	·883	·810	·054	·916	·166	..	..	..	..	·984	29·913	..	..	29·998
19	29·996	..	..	..	..	·0 5	..	..	·873	·844	29·994	·876	·158	..	..	..	..	·972	30·042	..	..	30·007
20	·957	..	..	..	..	·027	..	..	·913	·894	·965	..	·109	..	..	..	..	·992	·036	..	..	29·975
21	30·034	..	..	..	..	·084	..	..	·984	·904	·969	..	·106	..	..	..	..	·963	·071	..	..	·931
22	·029	..	..	..	..	29·992	..	..	·982	·954	·972	..	·144	..	..	..	..	·960	·067	..	..	·945
23	·033	..	..	..	..	·958	..	..	·992	·882	·931	..	·138	..	..	..	..	·912	·037	..	..	..
24	·148	..	29·933	..	..	·887	..	..	30·012	·827	·896	..	·131	..	..	..	..	·913	29·987	..	..	..
25	·100	..	·929	..	..	·856	..	..	·077	·866	·843	..	·115	..	[29·889	..	..	..	30·021	..	..	..
26	·064	..	·9-5	..	..	..	..	..	·033	·858	·855	..	·125	..	·824	..	..	..	·044	..	29 851	..
27	·093	..	30·022	..	..	..	29··32	..	29·974	·832	·831	..	·125	..	·847	..	..	..	·013	..	·909	..
28	·116	..	29 961	..	..	..	·829	..	·965	·791	·823	..	·113	..	·853	..	..	..	·027	..	·973	..
29	·110		·953		..		·9:6		·924		·861		·141		·792		..		..		·997	
30	·096		·985		..		·967		·955		·884		·055		·902		..		·058		30·026	
31	·081		·925		..		·676		·954		·883		·054		..		..		·043		29·990	

THE GREAT ATMOSPHERIC TIDE OF THE END OF JANUARY AND BEGINNING OF FEBRUARY, AS OBSERVED AT ADEN, MADRAS, AND BOMBAY, BETWIXT 1840 AND 1850.

	ADEN.								MADRAS.								BOMBAY.					
	1847.		1848.		1849.		1850.		1842.		1843.		1844.		1845.		1845.		1846.		1847.	
Dates.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.
1	...	29·855	...	29·957	...	29·937	...	29·797	...	30·023	...	30·007	...	29·938	30·001	29·931	29·909	...	30 092	29·987	30.017	29 961
2	...	·896	...	·907	...	·953	...	·760	...	·002	...	29·092	...	·939	29·984	...	·912	29·906	·099	30·031	..	30·005
3	...	·844	...	·961	...	·978	...	·802	...	·004	...	·954	...	·979	·996	·952	·928	·946	...	·055	29·971	29·937
4	...	·823	...	·941	...	·928	...	·805	...	29·976	...	·947	...	...	30·014	·954	...	·933	·012	·027	·982	·897
5	...	·803	...	·925	...	·924	...	·851	...	·969	...	...	30·032	...	...	·983	·943	·921	·027	·022	·963	·909
6	...	·832	...	·902	...	·918	...	·823	...	30·023	...	·924	...	·017	·076	·995	·954	·923	·104	·018	·958	...
7	...	·891	...	·8·9	...	·872	...	·794	...	·023	...	·937	...	29·968	·094	·999	30·024	·906	·093	...	·951	.969
8	...	·907	...	·882	...	·877	...	·809	...	·0·6	...	·966	...	·915	·0·8	30·006	·052	...	·061	29·953	·908	·941
9	...	·896	...	·882	...	·908	...	·841	...	·028	...	·960	...	·949	·074	...	·020	·976	·062	·946	...	·852
10	...	·819	...	·889	...	·956	...	·818	...	·019	...	·959	...	·983	·115	29·974	·042	·913	...	·945	·936	·803
11	...	·774	...	·904	...	·882	...	·780	...	29 986	...	...	...	·983	·116	·998	...	·901	.099	·966	·953	·842
12	...	·778	...	·881	...	·852	...	·789	...	·964	...	...	...	...	...	30·005	·055	·925	·063	·984	·926	·919
13	...	·853	...	·865	...	·889	...	·799	...	·955	...	...	...	·997	·065	·015	29·996	·920	·044	·985	·926	...
14	...	·886	...	·846	...	·940	...	·779	...	·982	...	...	...	30·037	·021	·002	29·944	·900	·065	...	·935	·930
15	...	·834	...	·868	...	·894	29·700	·782	...	·979	...	...	...	·001	·039	29·971	·967	...	·062	30·011	·945	·903
16	...	·834	...	·863	...	·879	·719	·803	...	·978	...	...	...	·032	·053	...	·982	·931	·032	·037	...	·852
17	...	·850	...	·842	...	·888	·766	·811	...	...	29·882	...	...	29·991	·056	·937	·986	·925	...	·017	·978	·868
18	...	·842	...	·828	29·853	·855	·789	·782	...	·959	·955	...	...	·988	·032	·935	...	·891	·057	·002	·958	·905
19	...	·830	...	·801	·884	·785	·777	·819	...	·934	·927	...	...	...	...	·944	·960	·886	·029	·030	926	·917
20	...	·764	...	·796	·914	·786	·760	·836	...	...	30·049	...	...	30·002	...	·923	·935	·847	·068	·027	·894	...
21	...	·760	...	·806	·936	...	·817	·828	...	...	·081	...	...	29·985	29·990	·917	·916	...	·042	...	·891	·903
22	29·723	...	...	·804	·913	...	·793	·750	...	...	·134	...	...	·965	·980	...	·913	·926	·065	29·985	·875	·903
23	·753	...	...	·774	·903	...	·773	·786	...	...	·153	...	...	·966	·980	...	·895	·888	·088	30·045	...	·884
24	·728	...	29·786	·770	·882	...	·792	·871	...	...	·102	...	29·918	...	·978	...	·909	·884	...	·082	·870	·901
25	·706	...	·777	...	·886	...	·826	·868	...	...	·072	...	·892	...	·950	...	·884	·902	·058	·079	·780	·889
26	·668	...	·774	...	·876	...	·820	·826	29·959	...	·037	...	·876	...	...	...	·882	·904	·079	·061	·810	·879
27	·673	...	·804	...	·903	...	·823	·803	·943	...	·034	...	·856	...	·951	...	·897	·891	·090	·060	·879	...
28	·710	...	·801	...	·922	...	·831	·800	·963	...	...	...	...	...	·946	...	91·	...	·049	·074	·851	·909
29	·761		·780		·952		·829		...		·042		·890		·950		894		·018		·874	...
30	·779		·844		·979		·851		·979		·037		·937		·918		·893		29·968		...	...
31	·806		·868		·936		·863		30·005		...		·950		·918		...		...		·883	...

THE GREAT ATMOSPHERIC TIDE OF THE END OF JANUARY AND BEGINNING OF FEBRUARY, AS OBSERVED AT CALCUTTA, BETWIXT 1840 AND 1850.

CALCUTTA.

DATES.	1839.		1840.		1841.		1842.		1843.		1844.		1845.		1847.		1848.		1849.		1850.	
	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.	January.	February.
1	..	30·011	..	29·955	..	..	..	29·988	..	29·933	..	29·934	30·098	29·949	..	29·999	..	29·895	..	30·085	..	29·957
2	..	·045	..	·991	..	..	..	·969	..	·867	..	·951	·094	·955	..	30·024	..	·899	..	·037	..	·999
3	..	·032	..	30·010	..	29·917	..	·960	..	·800	..	·942	·109	·9·6	..	·9	..	·949	..	·085	..	30·134
4	..	·004	..	29·990	..	·914	..	·920	..	·796	..	..	·083	·961	..	·082	..	30·010	..	·075	..	·158
5	..	·003	..	·965	..	·965	..	·872	..	·836	29·995	·991	·263	·996	..	·096	..	·07	..	·089	..	·102
6	..	29·973	..	·951	..	·936	..	·902	..	·799	·930	30·098	·269	30·054	..	·069	..	29·987	..	·070	..	·06:
7	..	30·043	..	·897	..	·959	..	·995	..	·74	·874	·043	·243	·063	..	·057	..	·069	..	·073	..	·081
8	..	·043	..	..	..	·964	..	30·002	..	·768	·911	29·988	·172	·060	..	·064	..	30·126	..	·073	..	·14(
9	..	29·947	..	..	..	·961	..	·007	..	·770	30·050	·911	·218	·051	..	·034	..	·121	..	·051	..	·143
10	..	·971	..	..	..	·925	..	·013	..	·773	·013	·85	·295	·63	..	29·996	..	·071	..	·14	..	..
11	..	·885	..	..	..	·924	..	29·974	..	·799	·0·8	·922	·302	·015	..	·903	..	·057	..	..	..	..
12	..	..	..	..	..	·938	..	·965	..	·809	·033	·996	·237	·062	..	..	..	·073	..	29·963	..	..
13	..	..	..	..	..	·959	..	·918	..	·833	·073	·969	·156	·032	..	..	..	29·982	..	·881	..	..
14	..	..	..	..	..	30·019	..	·874	..	·820	·044	·965	·121	·049	..	..	..	30·057	..	..	..	29·996
15	..	..	..	..	..	·032	..	·847	..	·824	·061	·983	·173	·05	..	..	..	·118	..	..	..	30·003
16	..	..	..	..	..	·028	..	·835	..	·830	·097	·955	·199	..	..	..	..	·100	..	..	..	29·993
17	..	..	..	..	..	·014	..	..	29·855	·749	·065	·929	·179	29·976	..	..	..	29·997	..	..	..	30·008
18	..	..	..	..	..	·068	..	..	·883	·810	·051	·916	·166	..	..	..	..	..	29·913	..	..	29·998
19	29·986	..	..	..	..	·0·5	..	..	·873	·843	29·994	·876	·158	..	..	..	..	·984	30·042	..	..	30·007
20	·957	..	..	..	..	·027	..	..	·913	·894	·065	..	·109	..	..	..	..	·972	·036	..	..	29·975
21	30·014	..	..	..	..	·09·	..	..	·884	·904	·069	..	·106	..	..	..	..	·992	·071	..	..	·931
22	·029	..	..	..	..	29·992	..	..	·982	·954	·972	..	·144	..	..	..	..	·963	·067	..	..	·915
23	·033	..	..	..	..	·958	..	..	·992	·882	·931	..	·138	..	..	..	..	·960	·037	..	..	..
24	·148	..	..	29·938	..	·957	..	..	30·012	·877	·896	..	·131	..	..	..	..	·913	29·957	..	..	..
25	·160	..	..	·929	..	·956	..	..	·077	·866	·843	..	·115	..	..	..	29·889	..	30·021	..	..	..
26	·064	..	..	·9·5	..	..	..	..	·033	·805	·855	..	·125	..	..	..	·824	..	·044	..	29·851	..
27	·093	..	30·022	..	..	..	..	29·372	29·974	·832	·831	..	·125	..	..	..	·817	..	·013	..	·909	..
28	·116	..	29 961	..	..	..	..	·829	·965	·791	·823	..	·113	..	..	..	·853	..	·027	..	·973	..
29	·110	..	·953	..	..	..	..	·9·6	·924	..	·861	..	·141	..	..	..	·792	..	..	..	·997	..
30	·096	..	·985	..	..	..	..	·567	·955	..	·884	..	·055	..	..	..	·902	..	·058	..	30·026	..
31	·021	..	·925	..	..	..	..	·6·6	·954	..	·853	..	·054	..	..	..	..	..	·043	..	29·990	..

Abyad, or White River,—the Bahr-el-Azrek, or Blue River, being denoted by the name Astapas,' which is totally distinct from and not to be confounded with the Nile. The coincidence between the two Native reports is, however, remarkable, especially when viewed in connexion with other cumulative information of precisely similar import both of ancient and recent date. The first Egyptian expedition in 1842 explored the Bahr-el-Abyad as far as 4° 22′ N. and lang, 31°45′ E. It was then descending from the S. E. and said to come from a lake. The Sheikh of Fasuolo told M. Linant, that South of the Shilouklis the Bahr-el-Abyad is lost in some extensive lakes—which that traveller considered highly probable from the prodigious quantity of fish which arrive with the freshes at their first appearance, for these fish could only come from lakes where they remain imprisoned when the waters are low, and escape when the inundation takes place. (Journ. Royal Geog. Soc. 11. 187.) The Baron von Müller when exploring the White River in 1843, received from a native some "striking information concerning its Arabic name. "The Bahr-el-Abyad," he said, "comes from *a mountain the top of which is quite white, and since it comes from the White mountain they call it also the White River.*" I may add that this man had never seen either snow or ice." Journal Royal Geograph. Society. Vol. 20 p. 287. This was written previous to Dr. Krapf's discovery of Mount Kenia.

The existence of two lakes, as feeders to the Nile, is mentioned by the Geographer Ptolemy who says (Book IV. 8) they owe their origin to the melting of the snows on the Mountains of the Moon. He places the one lake in Lat. 6° S. and Long. 57° E. from Ferro, and the other in Lat. 7° S. and Long 65° E. which, making allowance for the southerly excess of 10 or 12 degrees pertaining to all Ptolemy's Latitudes, would place the lakes about one or two degrees North of the equator, where recent modern information would also lead us to look for them. [This was illustrated by reference to the very excellent Map of Africa, constructed by the celebrated Gerard Mercator, in which that continent is delineated strictly in accordance with the description of Ptolemy. The lake Coloe, through which the Astapas or Blue river flows, and indentified with the Lake Dambea, is placed by Ptolemy on the equator, whereas its centre is in about 12° N.] There appears thus to be no doubt that this snow-capped mountain on the equator is one of Ptolemy's "Mountains of the Moon," and, Dr. Krapf's native informant is to be relied on, (though we should have expected the direction of the river to be N. E.) the true source of the Bahr-el-Abyad—at least of its eastern branch.*

The highest point to which the Bahr-el-Abyad has yet been ascended, which was by Dr. Knoblicher of Khartum, the Pope's Vicar General in central Africa, appears to be in Lat. 4° 9. N. as we learn from the Vienna correspondent of the 'Times,' quoted by Dr. Beke in No. 1217 of the 'Athenæum,' a spot several miles higher than the extreme point reached by the

* The accuracy of the opinions entertained by some of the ancient authors respecting the Nile is worthy of note. Lucretius, two centuries before Ptolemy, attributes the annual rise of this river to two probable causes, namely the periodical tropical rains at its source, and the melting of the snows on the loty mountains of Æthiopia :—

Nilus in aestatem crescit campisque redundant,
Unicus in terris, Aegypti totius amnis.
* * * * * *
Fit quoque, utei *pluviae forsan magis ad caput ejus*
Tempore eo fiant quo Etesia flabra Aquilonum
Nubila conjiciunt in eas tunc omnia parteis
Scilicet ad mediam regionem ejecta diei
Quom convenerunt, ibi ad altos denique monteis
Contrusae nubes coguntur, vique premuntur.
Forsit an Aethiopum penitus *de montibus altis*
Crescat, ubi in campos albas descendere nives
Tabificis subigit radiis sol, omnia lustrans.
De Rerum Natura. VI. 729.

expedition sent by Mahomed Ali, the late Pascha of Egypt to discover the source of the Nile Favored by a strong North-wind, and under the guidance of a skilful pilot, Dr. Knoblicher was enabled to ascend the great cataract which had stopped the further progress of Arnaud—much to the astonishment of the Natives, who were greatly surprised at the sight of the vessels and the white men. The Nile was then about 200 yards broad, and from two to three deep, and was seen trending away in a South-westerly direction, until it vanished between two mountains, beyond which, according to the Natives, the river came straight from the South.

We have no means of ascertaining the longitude of the extreme point to which Dr. Knoblicher thus succeeded in penetrating, which is to be regretted, as it appears that he was prevented furnishing himself with a chronometer solely by want of means; and what is still more painful—although about to resume his researches in the same quarter, he appeared, even in Vienna, to be still without this essential requisite, through inability to raise funds to purchase it.

Assuming, however, the longitude to be about 31½ E, and connecting this extreme point to which the head of the Nile has been approached from the North—with other points to the South of the water shed which separates the great Mediterranean basin of Africa from that which has its outlet in the Indian Ocean, the positions of which have been determined approximatively by Dr. Krapf and Mr. Rebmann, it would appear that the terra incognita remaining to be explored, and within whose limits the long sought for sources of the Nile are to be found—

Nile pater, quanam te possum dicere causa,
Aut quibus in terris occuluisse caput,

may be roughly described by an equilateral triangle, each of whose sides is about 370 geographical miles, and whose angles respectively are on the North, the extreme point reached by Dr Knoblicher as above; on the East, Mount Kenia in Lat. 0° 20′ S. and Long. 35° E.; and on the West, the great lake in Uniamesi, of which the northernmost point is laid down by Mr Rebmann (approximatively) in Lat. 1° 30′ S. and Longitude 29° E.

This lake in Uniamesi—which according to Dr. Krapf and Dr. Beke (Edinburgh New Philosophical Journal, Oct. 1848) signifies—"the possession of the Moon"—would appear to be fed from the southern slopes of the same mountains, the snows on the northern sides of which, melted by the sun when approaching and passing the Equator in March—"omnia lustrans,"—form the incipient streams of the Nile.* We have no modern information respecting Ptolemy's Western lake—but there is now every appearance of the correctness in the main of that celebrated geographer's account of the sources of the Nile, in lakes fed by the snows of the mountains of the Moon, being ere long established, or in the prophetic words of the famous D'Anville; a century ago, that "these objects" (the mountains of the Moon and the lakes of the Nile) "may yet appear in geography, although it is not deemed expedient at present to place them in the southern hemisphere."

Their description by Ptolemy is concise and minute' "round the Barbarian Gulf (Sinus Barbaricus—the bight of Zanzibar) dwell a tribe of Cannibal negroes (Æthiopes anthropophagi) on the west of whose country are the Mountains of the Moon, or rather the range or chain of the mountains of the Moon—Το τῆς σεήνης ὄρος the snows of which are received into the lakes of the Nile. Of these mountains," (or rather of this range)—"the one extremity

* The Egyptian expedition, when at the extreme point of their journey in January, found the river then falling, and were told that it would not begin to rise till the close of March.

is in 57° E. Long, and 12° 30′ S. Lat., and the other is in 67° E. Long. and 12°30′ S. Lat.

And of the lakes

The Western is in	57° E. and 6° 0′ S.
The Eastern in	65° E. and 7°0′ S.

The junction of the waters from the two Lakes 60° E. and 2° 0′ N.

Notwithstanding the errors in the absolute positions, both as regards Latitude and Longitude, of these localities, there is no reason to suppose that he is very far out in their relative positions. Making the usual correction, therefore, of 12° of latitude, it would place the entire range in 0° 30′S. which coincides with the latitude of Mount Kenia, which is undoubtedly the most easterly limit of the chain, and is placed by Mr. Macqueen, from a careful examination of Dr. Krapf's journals, as well as personal communication with himself, in 0°20′, S. It is of importance to ascertain the correct longitude of Mount Kenia, and it is to be hoped, that Dr. Krapf may be furnished with the means of determining it, when he undertakes his next journey.

Notwithstanding the accessions made to our geographical knowledge in modern times, the observation of Diodorus Siculus, (124) continues to be as applicable now as it was in the days of Augustus:—"Up to the present time no historical writer has asserted either that he has himself seen the fountains of the Nile, or the place whence it begins to flow, or that he has been told of it by any one who professed actually to have seen it." To this Bruce can hardly be considered an exception, inasmuch as that celebrated traveller himself admits that the White and not the Blue river, whose source he visited near Geesh, is the main branch of the Nile, notwithstanding the medallion prefixed to his work, on one side of which is represented himself, and on the reverse Apollo with his quiver on his shoulders, raising with his right hand the veil that concealed the source of the Nile, with a motto from Claudian—"nec contigit ulli hoc vidisse caput." It is to be hoped that the time is not far distant when the veil will really be withdrawn, and the lines be no longer applicable:—

Fluctibus ignotis nostrum procurrit in orbem,
Secreto de fonte cadens, qui semper inani
Quaerendus ratione latet; nec contigit ulli
Hoc vidisse caput.

Accounts of further explorations will be looked forward to with much interest. Meanwhile the friends of Geographical research are deeply indebted to the excellent and indefatigable missionaries at Mombas for the valuable accessions to science already made by them in the course of their arduous and harassing journies, and as I understand that the Church Missionary Society are preparing to carry out Dr Krapf's magnificent conceptions of establishing a chain of posts or stations, extending across the entire continent of Africa —from the Indian ocean to the Atlantic—commencing from both coasts simultaneously and meeting in the centre,—we may, shortly expect to receive much interesting information respecting these at present unknown countries. Dr. Krapf and Mr. Rebmann are to act as pioneers; the second station from the coast is to be Teita, about 120 miles inland, and when a third station is fairly secured, it will become the duty of the Missionary at that station to stretch his line into the regions beyond, to explore the country to the west, and select some favorable locality for the next station, leaving those already established to be occupied in succession from behind. A similar course is to be pursued from the west coast, under the auspices of the Bishop of Sierra Leone, commencing at some appropriate spot near the line, and as the entire breadth of the Continent of Africa at the equator does not exceed 1900 Geographical miles, the scheme appears to be by no means so impracticable as might at first be imagined.

In reference to this subject I would, with the permission of the Society, throw out a suggestion for its favorable consideration, whether we should not contribute in some degree to the successful carrying out of a scheme which promises to add so largely to Geographical science (for it is in this point of view only that the Society, as a body, can properly regard it) by presenting Dr. Krapf with a set of instrumen ts such as a pocket chronometer, sextant, barometer thermometer, prismatic compass, Nautical Almanac, &c, which would tend materially to the accuracy of his future observations. On throwing out this suggestion to the Rev. Mr Isenberg, his friend and former colleague, that gentleman assured me that such a present would be most acceptable, and that moreover, Dr. Krapf would, to the utmost of his power, to further the views of the Society in so far as he could do so without trenching on the paramount object of his mission. Mr. Smith added, that in the event of his suggestion meeting a favorable reception, it would be desirable that the instruments should be procured as soon as possible, as the season for the Buggalows leaving Bombay for Mombas is approaching its termination.

The Chairman said that the matter seemed of so much importance that Government ought to be applied to, to assist the Missionaries in their researches:—they appeared to be almost entirely without instruments of any description, and surely when they provided everything else for themselves, and imposed on themselves the task of discovery, the means of making it might be supplied them at the public charge, seeing how much the public were gainers by their labours.

It was stated that both at Poona and Bombay there were abundance of instruments, which the Court of Directors had provided for the Engineers' Institution, laying perfectly useless, and not likely to be required in the public service. It was added, however, that, in consideration of the importance of dispatch without loss of time, and the enormous amount of time required before any arrangement of this sort could be concluded with Government, it would be better that they should not be troubled on the subject, but that everything that was desired should be provided at once from private resources, so as to avoid trouble and delay, and save writing to the Government unnecessarily—which was unanimously assented to.

A large collection of very valuable works, from America, was laid on the table—presents from the Smithsonian Institution, and from the United States' Government, from whom a previous donation of much value had been received. It was remarked that the splendid works now before them, got up at the national expense, connected with the magnificent offer lately made by the National Observatory of fifteen hundred dollars to assist in the construction of Current Charts for the Indian seas, afford us views of the liberality and enlightenment of a Republican Government in a great measure new to us, and for which national prejudices had prevented us preparing ourselves.

The following is a list of the letters, papers, &c., laid before the meeting:—

LETTERS.

1. From Dr Ross, dated Kohat 30th Dec., 1851, enclosing a draft for Rs. 13, and forwarding meteorological register for June, July, August, and part of September, and October, taken at Kohat.

2. From C. C. Rafu, Esq., Secretary R. S. N. A. dated Copenhagen, 4th June 1851, forwarding for presentation to the Geographical Society, from the Earl of Ellesmere, the "Guide to Northern Archœology."

3. From Captain Gaisford, dated Ahmednuggur, 31st January, intimating his having made over the Rain Gauge to Captain Pottinger, on account of his being about to leave India.

4. From the Secretary of the Literary Society Madras, dated 15th January, informing that a copy of their Journal published since 1839, and at present procurable, will be forwarded at an early opportunity.

From Lieut. Rivers, dated Ahmedabad, 29th Jan., on the subject of establishing a tide gauge in the Gulf of Cambay.

From Dr Knight, dated Kotah, 23rd January, forwarding a draft on the Sub. Treasurer at Fort William for Rs. 209 on account of instruments.

From Messrs Remington &Co., dated 20th January, forwarding a copy of Society's Account Current made up to the 31st July, 1851.

From Venayekrow Jagonathjee, Esq., forwarding, for presentation to the Society, a Pamphlet on the Letters on the Cotton and Roads of India.

METEOROLOGICAL OBSERVATIONS.

From Ahmedabad, Alibag, Bhooj, Broach, Dharwar, Kholapoor, Pahlunpoor, Sawunt Warree, and Surat, for October, November, and December 1851.

From Calcutta, Sattara, stations of Cuddalore and Coconada and Trevandrum, for December.

From stations of Bangalore, Calicut, Cannanore, Chittoor, Cochin, French Rocks, Guntoor, Hurryhur, Kamptee, Madura, Mangalore, Mercara, Palamcotta, St. Thomas's Mount, and Trichinopoly, for November 1851:

From stations of Mergui and Tavoy for August and September.

From the station of Cuddalore, for October and November.

From Penang for October.

From Kohat for June, and July, August, and September.

From Nursingpoor from April to October, kept by Dr. Ford.

BOOKS.

Smithsonian contributions to knowledge, 2 vols.

History of the Condition and Prospects of the Indian Tribes of the United States, 1 vol.

Appendix 1 to vol. III of the Smithsonian contributions to Knowledge, containing Ephemeris of the Planet Neptune, for 1852.

Fourth Annual Report of the Board of Regent of the S. I.

Notice of Public Libraries in the United States of America.

Letters on the Cotton and Roads of Western India. Presented by Venayekrow Jugonathjee, Esq.

Guide to Northern Archæology. Presented by the Earl of Ellesmere.

THE Ordinary Monthly Meeting of the Bombay Geographical Society was held in its Rooms, Town Hall, on Thursday, the 11th of March 1852;—Members present, Captain Griffith Jenkins I. N., in the chair:—Commander W. C. Barker, I. N.; John Smith, Esquire; Lieut. E. F. T. Fergusson, I. N.; Manackjee Cursetjee, Esquire, and Professor Patton, Secretary.

The minutes of the last Meeting were read and approved of.

The Revd. Dr Krapf, who was duly proposed and seconded as an Honorary Member of the Society, was balloted for, and unanimously elected. Captain Barker, in support of the motion for the election of Dr Krapf, spoke strongly in favor of his zeal, talent, and energy, which he had an opportunity of frequently witnessing in Abyssinia.

The motion of Mr. Smith, for the purchase of the Blue Books for 1848 and 1851, published by the Admiralty was put and agreed to.

Professor Patton read extracts of a letter, from Colonel Sykes to Dr. Buist, in reference to his paper on the correction of the barometer for tension of vapour, and entered into a lengthened explanation of some points which had been misunderstood. In the paper, he stated he had been chiefly anxious to show the incorrectness of the present mode of making this correction; but had not substituted any thing in its place, because he conceived that in the present state of our knowledge it was impossible to separate the effects of the two components of the atmospheric pressure—the dry air and vapour. The barometer, he said, shows the total weight of a vertical column of the atmosphere, and it is impossible, without a knowledge of the mode in which vapour is distributed in the atmosphere, to determine its weight from its tension at the surface. The origin of this mistake is to be traced to Dalton's theory of gases of different kinds having no mutual action. Consequently, Vapour, which is considered as a gas, is unaffected by the dry air, and can only retain its tension at the surface, by the pressure of its own particles. But this theory having been proved untrue it will follow, as a necessary consequence, that the tension of vapour at the surface gives no indication of the total amount of vapour in the air, and cannot, therefore, be subtracted from the height of the barometer to give the pressure of the dry air. It cannot be denied, however, that whatever vapour exists in the air does actually press on the barometer with its whole weight. To believe otherwise would be to suppose that vapour had a principle of *lightness* in itself, and was not acted on by gravity. This affords a complete refutation of the idea broached by Colonel Sykes in his paper on the Meteorology of India, published in the last volume of Philosophical Transactions. He maintains that vapour, mingling with the dry air, expands it and makes it lighter, and in this way he accounts for the fall of the barometer before rain by the greater quantity of vapour then present in the air. According to him some correction should be *added* to the height of the barometer, in order to obtain the pressure of dry air.

In both these theories there is an element of truth which gives them plausibility; but both are in opposition to certain physical laws, and must be abandoned.

The observations of the Wet and Dry bulb Thermometers, and of Daniell's Hygrometer ought not to be neglected, since they give nearly correct indications of one of the most important climatic agents,—the state of moisture at the place of observation. These opinions have been submitted with great humility, and only after long deliberation and experiment; but they deserve consideration although opposed to the views of Daniell, Sabine, Divy, Glaisher Dove, Sykes, and almost all the principal meteorologists of the present day, who have written on the subject. Truth, in scientific matters, cannot be decided by authority, and is only to be arrived at by a free discussion on every point liable to dispute. The question now treated of must be admitted to be in that doubtful state, and it is believed that good will result from a reconsideration of it, although the views here put forward should not be ultimately confirmed.

Letters were read from Lieut. Fergusson, and Messrs. Smith, Elder & Co.

PRESENTS TO THE LIBRARY.

Bombay Magnetical and Meteorological Observations for 1848. Presented by Government.

Journal of the Indian Archipelago and Eastern Asia, for the month of October.

Meteorological Abstract kept at the Surveyor General's office, Calcutta, for January, 1852.

The Meeting then adjourned.

THE Ordinary monthly Meeting of the Bombay Geographical Society was held in their Rooms Town Hall, on Thursday the 8th April 1852;— Members present, Captain Griffith Jenkins I. N., in the chair:—John Smith Esquire; Jugonnath Sunkersett Esquire; John Ritchie Esquire, Venayakrow Jagonnathjee Esquire; John Macleod Esquire; and Professor Patton, Secretary.

The Minutes of last Meeting were read and confirmed. *Members Proposed.*—Commodore Sir Henry J. Leeke Knt.; R. N., by Captain Jenkins; seconded by John Smith Esquire, and Henry Leeke Esquire, proposed by Captain Jenkins I. N., seconded by John Ritchie Esquire.

The first business on the notice list was the motion by Dr. Buist, "That the Society order a further supply of such instruments as are not procurable for sale from dealers in Bombay." In reference to this the Secretary stated that in the absence of Dr. Buist it would be advisable to refer the motion to the Committee on Physical Research, who could examine into the details and ascertain the results of former orders of a similar kind.

The Secretary then read two interesting papers, containing "An account of the almost unprecedented fall of heavy rain in Scinde during the monsoon of 1851," and "Account of a very severe Earthquake on the frontiers of Upper Scinde," forwarded by Government with Mr. Secretary Lumsden's letters, No. 782 and 999 of 1852. He said that the Society is chiefly indebted to the labours of Mr. Frere, Commissioner in Scinde, for collecting the vast and very valuable amount of information now before them, and for which Mr. Frere deserves their warmest thanks. The Secretary was directed to convey to Mr. Frere their thanks for his valuable contributions.

Letters Read.—Nos. 782,998, and 999 of 1852, from J. G. Lumsden, Esq., Secretary to Government, General Department, and Letters from Messrs. Smith, Elder and Co., Major W. E. Baker, and W. C. Coles, Esq., Secretary Medical and Physical Society, Bombay.

PRESENTS TO THE LIBRARY.

Deaths in Bombay during the years 1848, 1849, and 1850. Presented by the Medical Board.

Index to the first ten volumes of the Transactions of the Medical and Physical Society Bombay.—Presented by the Medical and Physical Society.

PAPERS.

"Account of the almost unprecedented fall of heavy rain in Scinde, during the monsoon of 1851," and "Account of a very severe Earthquake on the frontiers of Upper Scinde," forwarded by the Commissioner to Government, and presented by them to the Society.

METEOROLOGICAL OBSERVATIONS.

From the Surveyor General's office, Calcutta, for the month of February, 1852.

From the Stations of Vizagapatam and Masulipatam, from December 1850 to October 1851.

From the Station of Rajahmundry, from December 1850 to August 1851.

After voting their best thanks to the several gentlemen for their very valuable contributions to the Library, the Meeting adjourned.

THE Ordinary Monthly Meeting and the Annual General Meeting of the Bombay Geographical Society were held in their Rooms, Town Hall, on Thursday the 20th May, 1852.

PRESENT.

Norman Oliver, Esq., senior member present, in the chair; Lieutenant Fergusson; Captain Kempthorne; Commander Jenkins; Dr. Haines; Dhunjeebhoy Framjee, Esq.; Dr. Buist, and Professor Patton, Secretaries.

The Minutes of last Monthly Meeting were first read and confirmed.

MEMBERS ELECTED.—Commodore Sir H. J. Leeke, and Henry Leeke, Esquire.

Member Proposed.—Dr. John Forbes Watson,—by the Secretary, seconded by Dr. Haines.

Letters Read.—Nos. 1195 and 1447 of 1852, from J. G. Lumsden, Esquire, Secretary to Government, General Department. No. 962 from John Scott, Esquire, Secretary to the Medical Board, and a letter from Captain A. B. Kemball.

The following Books &c., were laid on the table.

Books.

1. Manual of Physical Research for India. By Dr. G. Buist.—Presented by Government.

2. The Journal of the Bombay Branch of the Royal Asiatic Society, for January 1852, No. XIV. Vol. IV.—Presented by the Society.

3. The Journal of the Indian Archipelago, and Eastern Asia, for December 1851, and January 1852.—Presented by Government.

4. The Bombay Engineers' Report for the official year 1849-50.—Presented by ditto.

5. Transactions of the Medical and Physical Society, No. X.—Presented by the Medical Board.

6. The Geography of Hudson's Bay. By John Barrow, Esquire.—Presented by the Hakluyt Society.

Meteorological Observations.

From the Surveyor General's Office, Calcutta, for March 1852.

From the stations of Bangalore, Bellary, Calicut, Cannanore, Coimbatoor, Cochin, Chittoor, Cuddalore, Cuddapah, French Rocks, Guntoor, Hurryhur, Kamptee, Kurnool, Madura, Mangalore Mercara, Nellore, Palamcotta, Penang, Secunderabad, Saint Thomas's Mount, Tavoy, and Trichinopoly for the months of December 1851, and January and February 1852.

From Sattara and the stations of Cuddalore and Cocanada, for January and February 1852.

From the stations of Calicut, Cannanore, Cochin, Mangalore, and Palamcotta, for March 1852.

From Ahmedabad, Futtehgurh, and Kolapoor, for January, February, and March 1852.

From Bushire, from April to December 1851.

From the station of Salem, from January 1851 to February 1852.

From Bagdad, from September 1851 to January 1852.

Abstract of Mean Pressure, Temperature, &c., for the fourth quarter 1851, and for the whole year 1851, from four quarter observations made at Futtehgurh.

State of the Thermometer in the shade at Nusseerabad, for January 1852.

The business of the meeting was confined to mere matters of routine.

Annual Meeting.

The business of the Monthly Meeting being concluded, that of the Annual Meeting was entered on. The minutes of last year's meeting having been read :—

Report.—The Secretary stated that, according to custom, he would now proceed to lay a short account of the proceedings of the Society during the year before the meeting. The past twelvemonth had not been a very active or a very auspicious one, and an account of what had occurred would not occupy any great amount of their time. The number of members removed by death was unprecedentedly great : they had lost in this way their original founder Sir Charles Malcolm,—one of their Vice Presidents, Captain Hawkins,—and Captain Sanders and Messrs. Vaupell and Cormack, three of the most esteemed of their members. No member had in the course of the year returned permanently to England, and but one had resigned. On the other hand, three new members had been elected, restoring the balance of resident

members to within two. The books, maps, charts, globes, &c., for the "Ross Testimonial," had all in the course of the year been received, put in order by the sub-committee, the only part of whose labours yet remaining to be performed was the presentation of their report. The Society's scheme of Tidal and Meteorological Research, planned in 1846, and taken up with so much zeal and alacrity, and promising at one time such valuable fruits, had in a great measure slept throughout the year. The Society had deemed it inexpedient to proceed in the matter of constructing Wind and Current Charts, and on the munificent purposes of the Government of America becoming known, to assist them, if requisite, to the extent of 1500 dollars, the whole of the material collected had on its being received from the Society been made over by the subscribers to Lieutenant Maury, of the National Observatory, Washington, who had already written informing them that he had as much information at his disposal as would enable him to construct track charts for the Asiatic sea, and make a commencement with pilot charts and sailing directions: the subscribers meanwhile were exerting themselves to the uttermost, to supply him with all the nautical information they could procure, abstracts of logs having been dispatched for America by nearly every mail for some time past. The publication of the Manual of Physical Research having been abandoned by the Society, this had since been brought to a completion :—of 950 copies printed, 850 had been at once disposed of, and the work was nearly out of print already. A much larger impression of the second part, containing a manual of geological and mineralogical enquiry, an outline of the physical geography of India, with an index to nearly all that was in print on physics referring to the East would be thrown off to meet the demand. A large supply of Instruments for sale, such as were not to be had for purchase in Bombay, had just been ordered—they would probably arrive about the end of the year.

The large collection of Red Sea survey papers had been ordered by the committee to be printed entire: so many of them had already appeared in other publications, and there was so much matter of mere detail, interesting only at the time, that they would be re-submitted to the committee, with suggestions for curtailing them. The accounts were now made up, and would be placed in the hands of the finance committee for audit.

The following papers had been received in the course of the season, and had nearly all passed through the press for the next number of the Transactions :—

Researches in the vicinity of the Median wall of Xenophon, and along the old course of the River Tigris. By Commander Felix of the Indian Navy.—Presented by Government, with a letter from A. MALET, Esq., Chief Secretary, No. 2049, dated 17th May, 1851.

Report of the Survey of the Red Sea. By Captain ELWAN, I. N.

Particulars of Captain ELWAN's 2d voyage, and continuance of the Survey of the Red Sea.

Meteorological Journal of Captain ELWAN.

Sailing directions for the Red Sea. By Commander MORESBY.

Account of his visit to the Bay of Tajoora. By Lieutenant BARKER, I. N.

Memoir by Captain S. B. HAINES, I. N., of the South and East Coast of Arabia, with remarks on the Currents, &c.

Lieutenant CRUTTENDEN's report in reference to the wreck of the Honorable Company's Steam Frigate 'Memnon.'

A description of the Arabian Coast, from the entrance of the Red Sea, to Lat. 15°3′ N., and Long. 50°43′ E. By CAPTAIN HAINES —Presented by Government, with Mr. Secretary Goldsmid's letter No. 1526, dated 28th April.

Letter from the Resident at Indore, No. 300, dated 26th February, 1848.

Letter from A. JOHNSON, Esq., dated 25th Feb., 1848, to the Resident at Indore, with two sketches.

Letter from the Resident at Indore, No. 559, dated 3d May, 1848, and copy of Captain FENWICK's Journal of the passage from Dharee to Hirapul.

Letter from the Resident at Indore, No. 980, dated 21st September, 1848, and Captain FENWICK's Journal from Chikulda to Broach—Presented by Government, with Mr. Secretary LUMSDEN's letter, No. 383, dated 3d May, 1851.

Report on the Tooran Mull Hill, addressed to R. N. C. HAMILTON, Esq., by Lieut. THURBURN —Presented by Government.

A paper on the Correction of the Barometer for pressure of moisture, by Professor PATTON, —Presented by the Author.

A paper on the Volcanoes and Volcanic Regions, betwixt the Eastern Shore of the Bay of Bengal and Jibbel Tier, in the Red Sea, betwixt the parallels of 10° and 26° N., by GEO. BUIST, L. L. D. F. R. S. L. & E.—Presented by the Author.

Paper on the Geology of Bombay, by GEO. BUIST, L. L. D., F. R. S. L. & E.—Presented by the Author.

Paper on the recent discoveries of the East African Missionaries, by J. SMITH, Esq.

Account of the almost unprecedented fall of heavy Rain in Scinde during the monsoon of 1851. An account of a very severe Earthquake on the frontiers of Upper Scinde.—Forwarded by the Commissioner to Government, and presented by them to the Bombay Geographical Society.

It was proposed by Norman Oliver, Esq., seconded by Lieutenant Fergusson, and agreed to unanimously:—

"That Commodore Sir Henry J. Leeke, Commander-in-Chief of the Indian Navy, be elected President of the Society, in room of Commodore Lushington resigned."—Agreed to unanimously.

On examining the voting lists, the following were declared the Office-bearers for the ensuing year:—

VICE PRESIDENTS.	RESIDENT MEMBERS.
Hon'ble D. Blane, Esq.	S. S. Dickinson, Esq.
Colonel Holland	Dr. Morehead
Dr. McLennan	N. Oliver, Esq.
NON-RESIDENT MEMBERS.	J. Smith, Esq.
Major Rawlinson	J. Ritchie, Esq.
Major LeGrand Jacob	Commander Jenkins
Captain Ethersey	A. Malet, Esq.
Captain Fulljames	J. G. Lumsden, Esq.
Dr. Impey	W. Howard, Esq.
Lieut. Cruttenden	Captain Kempthorne
W. E. Frere, Esq.	Dr. Haines
Major John Jacob	Commander Barker

The Secretary then put the motion on the notice list, that the Society proceed to the election of Office-bearers other than those voted for by members out of doors, and agreed to:—

COMMITTEE ON ACCOUNTS.	COMMITTEE ON PAPERS.
Colonel Holland	S. S. Dickinson, Esq.
Commander Jenkins	Commander Jenkins
Dr. Morehead	N. Oliver, Esq.
William Howard Esq.	J. Smith, Esq.
N. Oliver, Esq.	Dr. Haines
John Smith, Esq.	Col. Holland, and T. Ritchie, Esq.
S. S. Dickinson, & A. Malet, Esquires.	

The Committee on Publication and Finance were continued,—Dr. Haines having been elected in place of Captain H. J. Barr resigned.

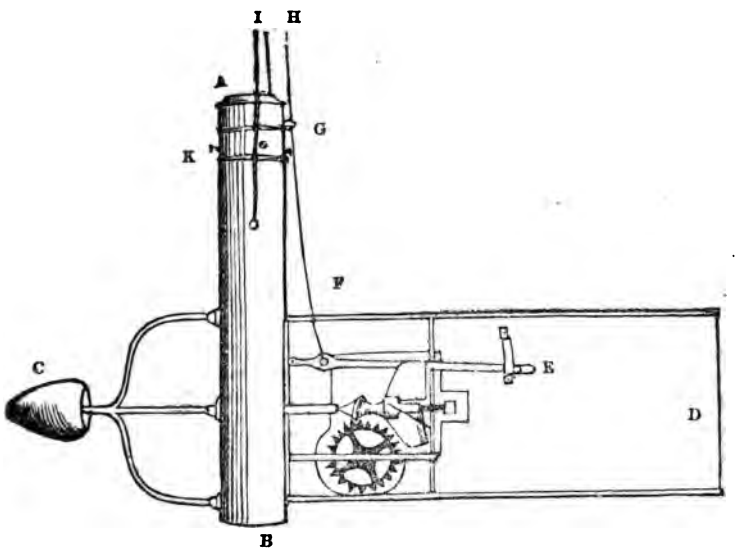
THE Ordinary Monthly Meeting of the Bombay Geographical Society was held in their Rooms, Town Hall, on Thursday the 17th June, 1852.——Commodore Sir Henry J. Leeke, Kt., President in the Chair.

The Minutes of last Meeting were read and confirmed.

SUBMARINE-CURRENT MEASURER.—An instrument contrived by Dr. Buist for determining the direction and velocity of currents under the surface of the sea, was laid on the table and explained to the meeting. This instrument, as first constructed, had been before the Society nearly two years since: an account of it would be found in the ninth volume of the Transactions. The principle of the first was very nearly the same as that of the second instrument, but the whole details were altered,—Captain Campbell having ascertained by experiment that it was next to impossible to exclude the water at great depths from the compass-box, and it appearing that the traversing of the needle was but little affected by water, and that steel might be protected either by electrotype gilding or by varnishing,—so the attempt to exclude the water was given up, and it was freely admitted. Under these considerations, and with an alteration in the contrivance for measuring the velocity, the whole became capable of infinite simplification. The instrument as it now stands might be constructed for from Rs. 30 to Rs. 50, according to the style in which it was made up. It consisted of a heavy lead or sinker, A B, two inches in diameter and 14 in length, and about 15 lbs. in weight. A hollow cylindrical compass-box of brass was slipped over the upper end of this, and made fast with screws. In this was a small pocket compass,—the brass card and needle protected by varnish; a lever arm for clamping the needle terminated in a small brass eye at G. The whole could be removed and taken to pieces to be dried or cleaned, without trouble: this was the direction posture of the implement. On the lower end of the sinker or lead was a copper vane, D, 14 inches long and 5 across, with a counterpoise at C: the whole looked like an inverted weather-cock, and when lowered down to any depth would of course turn in the direction of the current. A square hole was cut in the vane about one-third out from the cylinder—as near to it as to be beyond the reach of the eddy or dead water the cylinder itself might create. A fly like that of a window ventilator, or the vane of a patent log, was fitted up on an horizontal axle, turning on points to avoid friction: on this was a single thread or helix of a screw, which moved a vertical wheel of sixty teeth, also turning on points to avoid friction—the fly was three inches, the wheel it turned two in diameter. Over this was a simple latch like that of a door—it was loaded at the extremity E, and might be lifted from close by the fulcrum near the other extremity next to the cylinder. A brasswire was attached to the latch, and this passed through the eye of the compass clamp at G.—A stop or bead was here fixed upon it, by means of which it lifted the clamp and made fast the needle, leaving it so while it dropped the latch, which fell down and clamped the fly. The whole apparatus was suspended by a set of copper wires bound together every six feet by a fine brass wire, so as to be kept close as one, but within any twisting such as might occasion a tendency to turn round the vane. The copper wire rope as it may be termed was made up in lengths of fifty feet, united together by simple couplings, and might be employed to any extent that was required. The brass wire H F, which formed the lanyard, passed through a series of small loops along the line of the copper wires so as to slide through them without difficulty: when the whole was to be used the needle was unclamped and the fly left clamped by the latch E. It was lowered over the ship's side, care being taken that the brass wire remained perfectly slack, when the proper depth was attained, say fifty or five hundred feet, it was allowed a few minutes to swing freely, and so settle steadily in the direction of the current. The brass wire was now gently pulled up to a mark indicating that it had performed its task—a minute glass being at the same time turned—when the sand was run out, the wire was let go, and the whole hauled up.

By the pull on the brass wire the needle was at once fixed, and remained so while the fly was

liberated and permitted to revolve by the force of the current for the space of a minute, when the latch by its own weight with a sufficiency of leverage pulled out the wire a quarter of inch or so, sufficiently for to re-engage and stop the fly. On the whole being raised to the surface for inspection, the needle at once indicated the direction of the current, while its velocity was shown by the number of revolutions made by the fly as shown on the limb of the toothed wheel. These were marked off in figures, it having been before-hand ascertained from experiment how many revolutions in a minute indicated a mile an hour. There was no reason to doubt that in many cases, there were at the mouths of large inland seas successive sets of currents down from the surface moving in different directions and often altogether opposite to those above. By means of the present contrivance, all the peculiarities of these might be detected with the utmost facility. The currents just outside the Straits of Babelmandeb, as well as those at the debouchure of the Persian Gulf, were the most violent, complex, and perplexing, that could be imagined. There seemed no reason to doubt that this in a great measure arose from a constant influx of water from the outer ocean to compensate the enormous waste from evaporation, and the incessant efflux from below of water rendered heavy by concentration, hastening to mingle with those portions of the sea the monsoon had diluted.



These doctrines were first broached before the Society in 1849 and '50—they were embodied in their report for the year, and enlarged on in two papers in the ninth volume of their Transactions. They had been cited by Sir C. Lyell in his "Manual," and warmly commended by Mr. Maury, as embodying views closely coinciding with those he had himself about this time enunciated. It was to be hoped that much new light would be thrown by the Current machine on the facts on which these opinions were based. The original instrument was the property of Government, at whose expense it had been made up: the present was intended for H. M.'s Admiralty; and a third was in readiness for the use of the American Government, of

TRANSACTIONS

OF THE

BOMBAY GEOGRAPHICAL SOCIETY.

ART. I—*Account of the City and Province of Peshawur.* By H. G. RAVERTY, Lieutenant 3rd Regt. Bombay Native Infantry.

HISTORY OF PESHAWUR.

FROM the time of Alexander the Great, and, according to his historians, for a long period prior, the countries situated immediately west of the Indus, and lying between the lofty mountains of Hindu Kush on the North, and the Indian ocean on the South, were held by, and were subjected to, a Hindu race, up to the commencement of the eleventh century of the Christian Era.

The province now called Peshawur, was also subject to the same race of people, up to the period when Mahmood of Ghuznee first poured his victorious legions into the plains of India, to chastise the Infidel, and propagate the faith of his Prophet. At that time, it was called the Tuppah, or district of Bagram, from the town which bore that name, the present Peshawur.

During my residence there last year, by great good fortune I obtained a sight of a rare old Persian work, written in the reign of the great Baber, in which are given the particulars relative to Mahmood's undertaking his first expedition beyond the Indus, and the reason of his having changed the name of the province to Peshawur.

It stated that, cotemporary with Mahmood, there was a Raja of Sealkote, near Goojrat in the Panjab, by name Selghanee. This Chief wished to erect for himself a very strong fortress near to Sealkote; but he found it much more difficult to finish than to commence: in fact, that to complete it was impossible. Three sides stood well, but the fourth fell down almost as soon as it could be built up. On this circumstance occurring several times, Raja Selghanee collected together his Brahmins and Soothsayers, to ask their counsel in the matter, whose advice was, that it would be necessary to sacrifice a Mahomedan on the spot, and sprinkle the walls of the fort with his blood, after which the wall would stand, and the fortress be brought to completion. The people of the Chief were accordingly despatched in all directions to search for a suitable object, and after some delay, they brought back with them an old poverty-stricken woman, together with her only son, which latter was considered a fit offering to appease the anger of their Gods. The price of blood was offered to the mother, and of course refused; but the case being urgent, and Raja Selghanee finding that neither gold nor persuasion were likely to be of any effect, ordered that the boy should be taken by force from his mother and sacrificed, which was accordingly done; and the fort of Sealkote, in due time, completed.

The wretched mother, having been allowed to depart, proceeded to Ghuznee, to lay her complaint before, and seek for justice from, Mahmood, whom she met at a bridge near the city, as he was returning from the chase. On his being pointed out to her by an attendant, she cried out with a loud voice, "Ah! Champion of Islam! I come to demand justice at your hands: say will you listen to me here, on this bridge, or on that of Sarat?"* Mahmood answered—"It were better, oh woman, that I should hear your complaint here, for I may neither

* Bridge of Sirat, or al Sirat, the bridge of breadth, narrower than the thread of a famished spider, and sharper than the edge of a sword; over which the Faithful must enter into Paradise, to which it is the only entrance. But this is not the worst part of it, for the river which flows beneath, is the river of Hell itself, into which the unskilful and tender of foot, as might be expected, manage to fall—not a very pleasing prospect to those who have to follow.

A certain Moolah was one day holding forth in the Mujid, on the subject of Heaven and Hell, said that those who did what was right would go to the former, and those who did evil to the latter place; and that to gain the gate of Paradise, it was necessary to pass over the bridge of Sirat, which was narrower than a hair, and sharper than the edge of a polished diamond. An Affghan, who was present, and who had become very much concerned at this latter part of the sermon, at length rose up, and said, "Ah Akhund! you had better say at once that there is no road at all, if it is as you state, instead of deceiving people in this manner."

have time nor opportunity on the bridge of Sarat to attend to it." The woman then related her story, the account of which, as also the recollection of numerous other acts of tyranny and oppression committed at different times on the children of the Faithful by the infidel Hindus, filled the King with such rage and indignation, that he forthwith ordered his "Peshkhanah" or "Advanced Tent" to be sent on the first stage on the road to the Panjab. In a short time he arrived with an army at Jellalabad, after having experienced great opposition from the infidel on the road. After a halt of a few days, he advanced towards the Khaiber, with the intention of forcing the Pass. A. H. 399, A. D. 1008.

The plain of Peshawur was then held by a Chief named Seetah, who, together with his three sons, assembled a numerous army to oppose Mahmood. One of this Chieftain's sons was named Bagram, who held the town and district of that name. The second was named Eesar, who held Hashtnuggur, or the "eight towns," where, at the present day, there is an old ruin named the Killah of Eesar. The third son was named Bihee, who held the city and fortress of that name. The site of this latter place is about twenty miles North-west from Hashtnuggur, where a range of hills, of about 5 or 600 feet in height, rise abruptly from the plain. It is called the "*Takht*," or "Throne of Bihee," and is almost covered with ruins of Temples and other buildings, evidently of Hindu construction; the walls and carving of many of which are as fresh, and as sharp, as if erected but yesterday. This place I visited in January last, on my return to Peshawur with Colonel Bradshaw's force from the Eusufzai country.

Rajah Seetah having occupied the Khaiber pass with his forces, determined to oppose Mahmood to the last, and in consequence several battles were fought, in which Seetah and his troops were generally successful, not only from the strength of the positions which he occupied, but also from the great superiority of his army in point of numbers.

Mahmood, thus finding that to force the Khaiber would be attended with great loss of time, as well as of men, began to devise some other manner of entering the plain of Bagram. At length the idea struck him of constructing rafts of timber, which the neighbouring hills contained in immense quantities, and by means of these, conveying his army down

the Kabul river, to the plain of Bagram. Rafts were accordingly made, and the greater portion of the troops arrived within six miles of Seetah's chief town, before he became aware of their having left Jellalabad.

At the place where the Kabul river enters the plain from the Khaiber mountains, and near where the present village of Michnee is situated, the river separates into three branches, which run almost parallel to each other as far as Dobundee, where they again unite. The centre branch was taken by the forces of Mahmood, and this part of the river, as also the place where they landed, was from thenceforth called the "Na-guman," or the "Unsuspected." At the ferry, an old bridge now stands, and the place to this day retains the name of the "Guzar-i-na-guman," or the "Unsuspected Ferry." I may also add that the raft is a common mode of conveyance from Jellalabad to Peshawur up to the present time.

Mahmood himself remained behind, with a portion of his army, with the intention of penetrating through the Khaiber Pass as soon as the main body, which was under the command of one of his most experienced Ameers, should create a diversion in his favour; but before this could be effected in the manner it was intended, the force of Raja Seetah, having recovered from the temporary surprise into which it had fallen on the sudden appearance of the foe from an entirely unsuspected quarter, advanced to engage them, and a sanguinary engagement ensued, in which Seetah was entirely defeated, and the town of Bagram fell into the hands of the conquerors; and was thus, for the first time, annexed to the Ghuznee empire. It had been captured previously by Sabuktuggee, Mahmood's father, but had not been added to his empire.

A few days after these events took place Mahmood advanced with the remainder of his army through the Khaiber, and encamped near the village of Tahkal, which is about five miles west of Peshawur, and it was at this period that the latter name was substituted for that of Bagram. There are two accounts respecting this circumstance, both of which it is better perhaps to relate.

The first is, that the houses of the town of Bagram, which were scattered about in every direction, reached from the vicinity of the present Kabul gate of the city to the village of Tahkal. The ground here being very low, the Sultan did not like the situation; and having

remarked to his Ministers, in the course of conversation, that if the town had been built a little more to the East, where the ground was much higher, it would, in all probability, in time, become a large and flourishing city, his Ministers accordingly advised that orders should be issued to abandon the old town, and to erect new dwellings further to the East; which was consequently done, and in a very short time the new town began to increase. The Persian verb "to advance," or "to bring forward," is "Pesh-awerdan," and therefore Mahmood decreed that the name of "Peshawur," or "the advanced," should be substituted for that of Bagram.

This is the more probable account of the two; for at the present day the whole of the ground between Peshawur and the village of Tahkal is covered with marks of having been formerly the site of a large town, and numerous brick kilns and mounds can be distinctly traced; moreover, the ground takes a gradual slope towards the village of Tahkal.

The other story runs, that the Sultan's tent was pitched near the abovementioned village; but that on his arrival from Jellalabad, disliking the low situation of the ground, he ordered that the tent should be removed to a mound a short distance off, named Dakhee, which is just outside the Kabul Gate; and on which the Government Elephants are at present kept. From this circumstance, it is said that the city, which sprung up around, was ever after termed "*Peshawur.*"

Although Bagram occupied such an immense space of ground, still it could be scarcely termed a city; for most of the habitations were mere hovels, built of canes and plastered with mud; and were, as before mentioned, scattered about in every direction. The highest ground in the vicinity consisted of two mounds, viz. that of Dakhee before referred to, which extends for some distance East and West, and that on which the Gorkutree now stands. The best houses in the district were built on these high grounds, and were inhabited by the most wealthy of the people. At present some of the principal residences in the city stand on the former place, and are as formerly the property of Hindus; and this, with the exception of part of the suburb of "Ser Assea," is the quarter in which they almost exclusively reside.

The country round contained a great number of Mahomedan inhabitants, but they do not appear to have taken up their residence in the city in any numbers until Hindustan fell beneath the great Timur, at

which time, from its being situated in the main road from India and Kashmir to Khorassan and Persia, people flocked to and settled in it, from all parts of Asia, as did also the Affghans of the surrounding country; in consequence of which, the city began rapidly to increase in size, and improve in appearance.

Perhaps no city has witnessed more changes and vicissitudes than Peshawur: it has been captured and recaptured several times, has beheld the glory and good fortune of a conqueror lauded to the heavens to-day, and on the morrow seen him a fugitive and his power trampled in the dust. The principal events in its history are as follow:—

The most important event after the death of Mahmood of Ghuznee, who visited Peshawur on several occasions on his various invasions of India, took place in the year of the Hijerah 440, A. D. 1048, when Abu Ali, Kotwal of Ghuznee, arrived here on his way to take up the Government of India. In A. H. 441 A. D. 1049, Abul Hassan Ali having ascended the Ghuznee throne, a chief named Ali-bin Rubeah, in concert with another rebel named Meeruk Hassan, broke out into open rebellion. They forced their way into the royal treasury, and fled, with a small party of the Sultan's guards, who had joined them, to Peshawur, where they arrived in safety with their plunder. Having gained over several of the neighbouring chiefs by means of their gold, they succeeded in raising a powerful army, with which they subdued the whole of the countries between Kabul and the Indus, as far as Sindh south, as also the province of Mooltan, which they successfully held until the year of the Hijerah 444, A. D. 1052, when Sultan Abul Rusheed was raised to the Ghuznee throne, and these provinces were regained.

In A. D. 1180, Sultan Shahab-ud-Deen Mahomed Ghoree, the brother and successor of Allah-ud-Deen, and who extinguished the Ghuzneevede dynasty, overran the province of Peshawur and other parts of Affghanistan, which he subdued. Eleven years after this, in the year 1191 A. D., he arrived at Peshawur with an army of 120,000 men, for the purpose of subduing the Panjab, and was joined by his General Kutub-ud-Deen (who afterwards succeeded him to the throne) with a reinforcement of 50,000 horse and foot; and in return for his zeal, the daughter of Taj-ud-Deen, the Governor of Peshawur, was given to him in marriage.

In the year 1398 the great Timur arrived here, and crossed the Indus on the 12th of September of the same year. The Emperor Baber arrived in the province in 1518, and defeated the Eusufzai Affghans of Suwat and Bajour, who had overrun it; after which, he returned to Kabul. Baber returned to Peshawur next year en route to Hindustan, and again chastised the refractory Eusufzais who opposed his advance, after which he caused the Balla Hissar to be repaired and strengthened.

In the year 1554 Peshawur was visited by the unfortunate Humayoon, when he advanced into India to regain the throne of his ancestors, and drove the usurper Sikunder from the country.

The Emperor Akhbar advanced on Peshawur from Delhi in the year 1579, to chastise the rebels Mahommed Meerza and his brother, who were on their way from Kabul, with a large force, to seize the throne of the Moguls; but on the news of the Emperor's arrival at Attak having been received, his brother, together with his General, Hakeem Meerza, evacuated the province. The year 1586 saw Akhbar again at Attak, at which time he caused the present fort to be erected, and having detached a force into Suwat and Bajour, against the Eusufzai Affghans, he returned to Delhi.

Ferishta, in his *Tarekh*, says, that in the same year, viz. 1586, a force was sent against the Roshnai Affghans, called also Zundakah Kaffirs, and that the detachment returned to Attak without having effected the object of the expedition, namely, the opening of the communication between Peshawur and Kabul.

I have made numerous enquiries, and endeavoured to find out who those Roshnai Affghans or Zundakah Kaffirs are, but without success. Perhaps the people whom Ferishta means, are the "Seeah Posh," or "Black clad," the inhabitants of Kaffiristan, a country situated north of Jellalabad, but who are no more Affghans than they are Esquimeaux.

In the year 1592 or 3, it is said that a chief named Jaafer Khan, Khan of the Kuzwanee tribe, gained a victory over a large body of Khaiberries in the Khyber Pass: perhaps these are the Roshnai Affghans, to whom the historian refers.

The next event of moment in the history of Peshawur was the arrival there, in the year 1738, of Nadir Shah, on his rapid advance into Hindustan. After having sacked Delhi, and re-seated Mahommed on his throne, in return for which he exacted the cession of the whole of

the countries west of the Indus, including Peshawur, Kabul and Kandahar, he returned to Persia by the same route as he had advanced, and after crossing the Indus at Attak, he built the small fort of Khairabad, opposite the latter place.

In the year 1748, Ahmed Shah Abdalhi, who by his own talents raised himself from the office of Chobdar or Stick-bearer to Nadir, to the throne of Affghanistan, having made himself master of Kandahar and Kabul, advanced on Peshawur, from which he drove Nusseer Khan, the Nazim or Governor of the Mogul Emperors, across the Indus, after capturing the city. He was also so fortunate as to find here a large sum of money on its way to Persia, which was appropriated to his own immediate wants, and furnished him with funds to carry on his intended operations in India. He placed a Nazim of his own to govern the province, and left behind a body of troops for its protection, under one of his Sirdars. He died in 1773, and was succeeded by his son Timur, a weak and timorous prince, throughout whose reign anarchy and confusion reigned supreme, and the effects of which were felt at Peshawur as well as in other parts of Affghanistan.

In 1779, the Sahibzadah of Chumkunee, (a village about six miles east of the city of Peshawur, and one of the best in the whole province,) under the pretence of an expedition into the Punjaub entered into a conspiracy against Timur Shah, and having gained over the chief of the Khulleel tribe, named Faizallah Khan, raised a body of Affghans, mostly composed of Afreedees and Shaimvarees, and attempted to surprise the Balla Hissar, under the pretence of showing his troops to Timur, who resided in the fortress at the time. This treachery was, however, fortunately discovered, through the vigilance of the guards of the Ghoolam Khanah and a few Dooranee Affghans, who repulsed the rebels with great slaughter. Shah-i-Teman, son and successor of Timur, arrived at Peshawur in December 1793, for the purpose of collecting an army for the invasion of India, at the instigation of Tippoo Sultan.

In pursuit of this phantom of conquest, which appears to have haunted the imagination of this unfortunate prince for many years, he advanced from Peshawur with an army, for the first time, in the latter part of 1775; but had scarcely effected the passage of the Indus, when he received news of the invasion of Khorassan, by the Shah of Persia, on which he retraced his steps, and returned to Peshawur, which he reached

on the 3d January 1796. In November of the same year, he returned from Kabul, and assembled an army of 30,000 men, and proceeded to Lahore, which he entered in the month of January 1797. He advanced again on Lahore in 1798, and returned to Peshawur the next year ; where, after a short stay, he proceeded to Herat. In the year 1800, Shah-i-Zeman, again came to Peshawur ; but, hearing shortly after of the fall of Kandahar into the hands of Futtih Khan, he departed for Kabul to oppose the coming storm, leaving Shujah-ul-Mulk, his brother, in charge of his family and treasure, with a strong force for their protection.

During the disturbed reign of Zeman and his successor, most of the wealthy inhabitants fled from Peshawur, to escape the tyranny and oppression of the Affghans. Robbers assembled in the streets in bands of fifty and a hundred at midday, and at night, with lamps in their hands, boldly issued forth to plunder the wealthy and the defenceless. The Shah's Nazim was himself a mere robber, for whenever he heard of a man being possessed of wealth, he contrived, by false accusation or some other rascally means, to get possession of his wealth and property.

During the stormy years that followed the flight of Shah Shujah, up to the period when the province fell into the hands of the Seiks, these robbers continued to infest the city, after which time the strong measures adopted by the Seik Governor effectually put a stop to their depredations.

We must now for a short time turn back to the year 1801, when Shujah, on hearing of his brother's defeat by Futtih Khan, assembled a large force at Peshawur, and advanced on Kabul, but sustained a defeat. In 1802, Futtih Khan, on his way to Kashmir, levied a contribution on the city of 50,000 Rupees. In 1808 Peshawur fell into the hands of Prince Kaisir, son of Shah Zeman, who, during the absence of his uncle Shah Shujah in Sindh and Mooltan, had been proclaimed King by the Mukhtar-ud-Dowlah Sheer Mahomed Khan Populzai, and the celebrated Peer Meer Waez. The account of this affair not having been fully noticed in most of the works on Affghanistan, I will relate it at length.

In the latter part of the year 1807, Shah Shujah marched from Kabul, via Kandahar, with an army en route to Sindh and Mooltan, for the purpose of arranging the affairs of those provinces, leaving Prince

Kaiser, his nephew, in the government of Kabul. Sheer Mahomed Khan Populzai, the Mukhtar-ud-Dowlah, who was then absent in Kashmir as Governor of the province, dreading in his heart lest Shah Shujah might find an opportunity of ruining him in revenge for some crime previously committed, seized the apportunity ofthe Shah's absence, left his Government, and returned to Kabul. He immediately commenced intriguing with Prince Kaiser, and offered to make him King. The Prince was deaf to all his proposals for a long time, well knowing, that in case of failure, his own life would be the forfeit. Sheer Mahomed Khan, on hearing his reasons for refusing, said, "but if the Ameers, the troops, and the people, of their own accord, choose you for their King, what can Shujah-al-Mulk do to prevent it"? After some time, however, Kaiser agreed to his request.

The Mukhtar-ud-Dowlah's next object was, to gain over the Meer Waiz, who, at this time, was the Peer or Saint, and therefore greatly respected by the whole of the people of Kabul, with the exception of the Kuzzilbashes.

Having gone to the Meer Waiz, the Mukhtar-ud-Dowla represented to him the immense advantages they themselves would acquire, in case they could place Kaiser on the throne, and, moreover, that the whole of the affairs of state would fall into their hands. It was therefore agreed between them, that the Meer Waiz should go to the principal Musjid on the succeeding Friday, and harangue the people on the subject from the pulpit. This was accordingly done, and Meer Waiz declared that Shujah-ul-Mulk was a sensualist, and a drunkard, and thereby unworthy to be King of the Faithful; and that, as Prince Kaiser was young, a worshipper of God, a pious man, and, moreover, a protector of the poor and helpless, he was, therefore, fit to be their Sovereign. The people of Kabul acted as their Peer had advised, and Kaiser was accordingly proclaimed King, in the place of Shah Shuja-ul-Mulk.

The Kuzzilbashes, who had beheld all this with dread, and having ever looked on the Mukhtar-ul-Dowlah, and the Meer Waiz, as their inveterate enemies, wrote the whole account of the affair to the Shah, and despatched it with a trusty messenger. News of the insurrection reached Shah Shujah at Mooltan, from which place he immediately marched with the small force at his disposal, crossed the Indus, and advanced on Peshawur, by the Derajat and Kohaut.

Kaiser and his advisers were well aware, if Shujah should reach Peshawur, and advance on Kabul from the former city, that people would flock to his standard from all quarters, and he would thus have an immense force at his disposal; but that if they could succeed in reaching Peshawur before the Shah, who could not have more than five or 6,000 men with him, the advantages would be on their own side Kaiser therefore collected together a force of about 20,000 men, consisting of Kabulees, Affghans, Dooranees, Ghiljees, Kohistanees, and Kuzzilbashes, and advanced on Peshawur. Shujah had, however, arrived before him, and when Kaiser and his army emerged from the Khaiber Pass, they discovered the force of the Shah encamped on the dry bed of the Sharmawalah, about five miles west of Jumrood. The next morning, 3d March, 1808, the two armies advanced against each other, and met near the village of Jumrood. After fighting against treble their numbers for some time, Shujah's infantry fled on all sides. The Shah himself, with 1,000 Kuzzulbash horse, who remained unbroken, was about to quit the field, when an unexpected event occurred, which entirely changed the fortunes of the day.

Seeing the flight of Shujah's foot, as before stated, Sheer Mahommed Khan, the Mukhtar-ud-Dowlah, collected the principal Ameers around him, and with the flower of his troops advanced on the Kuzzilbashes who remained around the Shah, in hopes of taking him alive.

The Kuzzilbashes on each side were well aware that, if Shah Shujah should fall into the hands of the rebels, and Kaiser be firmly seated on the throne, the Mukhtar-ud-Dowlah, and the Meer Waiz, together with the Ghiljees and other inveterate foes of their tribe, would destroy them almost to a man, and that their very existence depended on the success of Shujah-ul-Mulk, at the critical moment referred to, joined together, and attacked the other forces of Prince Kaiser, and a hand to hand combat ensued. The Mukhtar-ud-Dowlah, and Akram Khan, the two brothers of the former, Mahomed Ameer Khan Noorzai, Abdoolah Khan Faizullah Khan Populzai, Dilawer Khan Alyezai, and the greater number of the Chiefs of Kaiser's army, were killed. Kaiser himself, thus completely vanquished, and his Army routed, fled to Kabul, where he was soon followed by Shah Shujah.

Meer Waiz, on hearing of Kaiser's defeat, fled to the Koh-i-Daman, and there collected a number of men of the tribes in that quarter, with whom he advanced towards Kabul, but his own followers gave him up

to the Shah, by whom he was handed over to the Kuzzilbashes. After torturing him in several ways, they put him to death: this done, they delivered his body over to one of the Khojahs (Eunuchs) of the Shah. It afterwards became a saying throughout the Country, "that the Khojah Billal had killed the Meer Waiz," to the great disgust of the Sunnees.

Peshawur constituted part of the Dooranee Empire up to the year 1818, and on the death of Futtih Khan, was held for some time by his brother, Azeem Khan, who collected the revenue in the name of Shah Eyoob.

In consequence of the disturbances which took place at Kabul shortly afterwards, this Chief evacuated Peshawur and returned to Kabul, and the country was immediately pounced on by the "Lion of the Punjab." The Affghans made several attempts to recover the province, but without success.

In 1823, Runjeet Sing having passed the Indus with a large force, advanced on Akorah, the first march towards Peshawur, to oppose Sirdar Azeem Khan, who had arrived at Pubee, the first march from Peshawur, with a force from Kabul, for the purpose of recovering the province. The two armies marched from their respective encampments on the same day, and met a little on the Attak side of Nohshaira, where a skirmish took place, in which the Affghans were beaten; and the Sirdar withdrew his troops to Peshawur, and soon after retreated to Kabul. At the time this skirmish took place, a large body of Eusufzais, to the amount, it is said, of 20,000 men, calling themselves Ghazees or Champions of the Faith, were assembled on the opposite bank of the Kabul river, for the purpose of crossing over to the assistance of Azeem Khan, but before they could effect this that Sirdar had withdrawn his troops.

Runjeet seeing this force on the opposite bank, crossed the river with his whole force, and attacked the Eusufzais, a little to the N. W. of Nohshaira, where they drew up to receive him. They had no leaders, and were mostly armed with swords and clubs, yet believing what their saints had told them, to the effect that the cannon balls of the infidel Seiks would not injure them, they made no effort either to advance or retreat, but remained drawn up in a mass.

Runjeet, it is said, offered them terms, but of this we may believe as much, or as little, as we like; one thing is, however, certain, he ordered his guns to be placed in position around the Eusufzais, and having

ordered that no small arms should be used, these unfortunates were mowed down by his cannon, until night closed the scene. They made no efforts to escape, and it is said that 10,000 perished on the spot, while the remainder, most of whom were wounded, retired under the darkness of the night; when Runjeet withdrew his troops, and the next day advanced towards Peshawur.

Runjeet Sing finding, notwithstanding his success, that such was the implacable and inveterate hatred of the people of the country to the Seiks, that to retain Peshawur would be almost impossible, made it over, much against his will, between Shah Kamran of Herat, the legitimate claimant of the Dooranee throne, and the latter's most bitter foe, Dost Mahomed Khan, Barakzai, the present ruler of Kabul. The Maharaja, however, exacted a small tribute, and an acknowledgment of supremacy.

Dost Mahomed made himself master of the whole province in 1824, which, two years after, he conveyed to his brother, Sultan Mahomed Khan. He, in return for his brother's kindness, commenced intriguing with the Seiks; and whilst the ex-Shah Shujah was endeavouring, in the year 1834, to recover his lost authority, Sultan Mahomed Khan entered into a secret treaty, with not only the enemies of his country, but also of his faith; and Runjeet Singh, under the pretence of assisting the rebel, introduced a body of troops into the Balla Hissar, and retained the province for himself. In the treaty between Shah Shujah and Runjeet Singh, in 1833, the latter had obtained a grant of the province of Peshawur; and Sultan Mahomed Khan, having at the same time objects of self-aggrandizement in view, Runjeet pretended to accede to his terms, the better to secure the grant made to him by Shah Shujah, in which, as above related, he was as usual successful.

Dost Mahommed made an attempt to regain Peshawur in 1835, but was defeated by the Seiks near Jumrood, in which affair they lost their general, Hurree Singh.

In the month of November, 1848, Dost Mahommed, taking advantage of the Seik rebellion, dispatched an army of 12,000 men from Kabul, under his half brother, the Nuwab Jubbar Khan, and took possession of Peshawur. He retained it, however, but a short time; for in March, 1849, the force of Sir Walter Gilbert, G. C. B., arrived at Peshawur without meeting with any opposition on the part of the Affghans, who fled before our victorious troops.

Dost Mahommed is said still to be desirous of regaining this

fine province; in fact, every Affghan appears to regard it as the apple of his eye. That it is the natural boundary of our Empire in that quarter, as also the key of Affghanistan, I imagine no sensible person is prepared to dispute.

Description of the City and Suburbs.

The city of Peshawur, which is distant from the right bank of the river Indus or Attak, forty five miles, is situated in a large plain, having on three sides mountains, which increase in height as they recede, more particularly towards the North. It is of an irregular oblong form, surrounded by a substantial wall of unburnt brick, twenty feet in height, and strengthened by round towers or bastion at the angles.

The circumference of the city with the large Suburb of "Sir Assea," which has its own walls and gates, is five thousand five hundred yards, and has thirteen gates, viz. the Kabul, Jehangeerpurah, Assea, Bachowree, Kohaut, Gunj, Wuzeerabagh, Lahore, Doabah, Kampurah, Raitee, Chubutrah, and the Balla Hissar gates. At each of these gates there is a guard of the city police, and during our stay at Peshawur, the Kohaut, Kabul, Gunj, and Wuzeerabagh, gates, were also guarded by our own troops.

The ground on which the city stands is tolerably level, with the exception of the "Bullundee-i-Dakhee" or height of Dakhee, near the Kabul gate to the West, and the height on which the Gorkutree stands to the East.

It was on these two heights or mounds that the principal houses of Bagram stood. The intermediate space where the "Gunj-i-Noh" or "New Grain Market," the "Bazar of the silk sellers," and the "Bazar of the cloth sellers," as also the whole ground extending to the Gorkhutree was, in the time of Sooltan Mahmood, a marshy jungle, infested with wild beasts. A rivulet runs through the western side of the city: it enters at the Kabul gate, and after taking a considerable bend, and running through the "Gunj-i-Noh", or "New Grain Market," comes out near the Raitee-Gate on the northern side. It is crossed by several stone bridges, and in some places willows grow on its banks, but not to the extent or luxuriance that might be imagined from the descriptions of Burnes and the other travellers.

The appearance of the higher part of the city, with the large and gloomy houses seemingly piled one on the top of the other, is at times

highly picturesque, particularly from the Grain market and the Silk-sellers' bazar.

The houses, few of which are worth noticing, although many of them are large, and for the most part built of burnt bricks (which is difficult to distinguish from unburnt brick, on account of the dusty colour of the buildings, occasioned by the dust storms which greatly prevail in the hot season) are generally erected in wooden frames, on account of the frequent occurrence of Earthquakes, which are common in this district, as also in all the northern parts of Affghanistan. Many of the houses are three stories in height, the second and third of which have often fronts of carved wood and open work, which admit both air and light, and, at the same time, prevent their room from being seen into from without. In most of the principal streets the lower parts of the houses are occupied as shops, which are, however, in no way connected with the upper part, the latter being accessible by a stair at the side of the house. The roofs are all flat and plastered with mud, and surrounded by a parapet four or five feet in height.

In the hot weather the people pass a great deal of their time on the house tops, and on which, in this season, they invariably sleep. On this account it is considered a crime to overlook the roof of your neighbour's house from your own, as you might by doing so see the ladies of the family. The houses of the better sort of the people contain *Tah-khanas* or Zeerzaminees, rooms under ground, in which the females, when not employed in household matters, spend the whole of the day. The heat of a house in the hot season, which continues for three months, is at times very great, often reaching to 100° of Fahrenheit.

Several streets are as wide as the streets of many of our towns at home, for which General Avitabile, or as he is called by the Peshawurees Abutabile Sahib, must be thanked. During the period that he was Governor of the Province, he made many improvements: he, in fact, almost rebuilt many parts of the city, and although he ruled with the "rod of iron" yet still his name is greatly respected. The Peshawurees say he was a just man, and that instead of entrusting its administration to overbearing Hindustanies, he administered justice himself, heard every complaint, and was accessible at all times to the meanest person. The door of his residence was not surrounded by swarms of lazy peons to keep those who cannot afford to bribe them and the Moonshees from access.

The whole of the principal streets had formerly been paved with large round stones, similar to the streets of many of our towns at home, with the exception that they slope towards the centre, which forms a gutter. In the streets widened by the Seik Governor, these stones have been dispensed with, but the old streets, which are narrow and intricate, still retain the stone pavement.

The "Bazar-i-Abreshur Taroosh," or "Bazar of the silk-seller," is a very pleasant place, octagon in form, and surrounded by mulberry trees, and the houses round about are inhabited by the richest merchants. The "Bazar-i-Bazaran," or "cloth sellers," which adjoins it, as also a fine large open space, planted with trees, but it is oblong in form, and much larger.

The city of Peshwaur has two suburbs, the largest of which is called the "Sir Assea" or "Mill Head," the other the suburb or village of Balla Maree, or as it is commonly called Bana Maree.

The Sir Assea, which is a good seized town in itself, is merely separated from the city by a wall, (see Plan) built by Avitabile to prevent the people of Sir Assea from quarreling with the inhabitants of the "Gunj-i-kohnah," or "old grain market," between whom a jealousy from some cause or other existed, and party fights were of common occurrence, in which lives were often lost. On the night of Shab-i-Barat, (15th of the month of Shaban) they used regularly to meet and assail each other with fireworks. On one occasion the Seik Governor favoured the rivals with a meeting outside the city, to enable them to indulge in their fighting propensities, on which both young and old engaged. On this occasion three persons were burnt to death, and a great number injured in several places. To the friend of those who lost their lives, Avitabile gave each one hundred rupees, and to those who were wounded, rewards according to the nature of their injuries, but the system was put a stop to.

This suburb is also surrounded by a wall similar both in height and material to that of the City, to which there are six gates. It has several fine Houses and Musjids, and is inhabited by Hindoos, of the Khutree tribe, and Mahomedans, in about equal numbers. The village or suburb of Bala Maree or Bana Maree is situated close to the Sir Assea on the west, but is entirely separated both from it and from the city. It was once a large place, but has now fallen to decay: it however still contains about one hundred good houses, and taking

it altogether, it has a very picturesque appearance. Numerous gardens or orchards surround it on all sides for more than a mile, the whole of which are with but few exceptions in a high state of cultivation.

The following is the total number of houses in the city, together with the number and places of residence of the different shopkeepers and artizans, which I obtained with great labour and trouble, and without either assistance or enquiry from any of the Officials of the Province, or any one in any way connected with them. Considering the manner in which I was thus situated, it may be depended on as being very correct.

Mahomedans of various denominations, 4,989 Houses. | Hindus, Seiks, and Khutrees, 2,317 Houses.

Total 7,306 Houses.

Besides this number in the city, there are, belonging to the Sir Assea and the Gunj-i-Khonah, 725 houses, inhabited by weavers of Loongies or Scarfs, who are chiefly Peshawurees, 218 houses of weavers of other cloths, chiefly Kashmirians and Peshawurees, 113 houses inhabited by the Shalikoban or cleaners of gram as they are termed, who live in a Street called the Mahalah-i-Shalikoban. They are chiefly Kashmirians, and have shops attached to their dwellings. All these together give a total of 1088 houses, which, added to the number of houses in the city, give a grand total of 8394, and, at the usual computation of five persons to each house on the average, give the number of the inhabitants of Peshawur at 41,970, which cannot be far wrong: the troops and camp followers amount to about 12,000 more.

The different trades &c. are divided as follow, into shops, each of which employs from six to seven persons, viz. Armourers or Sellers of Arms 11, who are Peshawurees and Kashmirians, and reside chiefly near the "Pul-i-Sungee" or "Stone Bridge"; Armourers or cleaners of arms, 9, are Peshawurees who reside in the Bazar-i-Kissah Khoane, and Bazar-i-Kalan; 44 Master Bricklayers, Peshawurees, reside in all parts of the city, but principally in the Mahalah (quarter or Street) Ander-Share; 15 Beef Butchers, Peshawurees, who reside in the Bazar-i-Duma Gullie; 63 Sheep Butchers, Peshawurees also, and reside in almost every Street and Bazar; 13 Bookbinders, residence Bazar-i-Musjid-i-Mahabat Khan; Bankers and money-changers 45, who are Hindus of the Khutree tribe, and reside in the Street of Mahabat Khan; 33 Bankers, Peshawurees, who are to be found in every Bazar; Barbers

87, who are mostly Kashmirians, with some few Peshawurees, they have no regular shops, but frequent the Baths and Bazars; 24 Master Carpenters, are Peshawurees, and have no separate place of residence; Cook shops 15, chiefly Peshawurees, who reside in different Streets and Bazars; Cookers of Sheep's Heads 11, Peshawurees, and reside in different parts of the city; Confectioners 56, who are Hindus, and reside in different Streets; Carvers and Painters 18, Peshawurees, scattered about in different streets; Drapers 52 shops, they are kept by Hindus, almost exclusively reside in the "Bazar-i-Bazaran" or Drapers' Bazar; Dyers 76, all Peshawurees, who reside in different streets; Druggists 57, Hindus, are to be found in every Bazar; Fishmongers 15, Peshawurees, residence Bazar-i-Kalan; Goldsmiths 41, are all either Hindus or Kashmirians, and are to be found in every Bazar; General Dealers and Deealers in small wares 16, who have a row to themselves in the Bazar-i-Kalan and Bazar-i-Gorkutree; Horseshoe makers and shoers of Horses 16, are Peshawurees, and reside in the Gunj-i-Noh and Bazar-i-Jehangheerpurah; Mat-weavers 11, Peshawurees, whose residence is in the Chouk; Milk sellers 37, Hindus and Peshawurees, and are to be found in every street; 25 Oil merchants, who are Peshawurees, and dwell in the Mahalah-i-Gorkhutree; 11 Plumbers, who are of seven different classes, and are scattered about the different Bazars; Sellers of Philudah 10 (this is a sort of porridge made from wheat and milk,) Peshawurees, who dwell in the Bazar-i-Kissah Khoane and Bazar-i-Kalan; Paper makers 22, are Peshawurees and Kashmirians, and reside in the Gunj-i-Khona and a street named after them called the Mahalah-i-Kazir Kalan; Rope makers 11, Peshawurees, four of whom are in the Bazar-i-Kissah Khoane and the remainder live in different streets; Shoemakers 58, are all natives of Peshawur, of whom 23 are makers of women's shoes only—they principally reside in the Rastah-i-Kafshdor or Shoe-makers' Row; Saddlers 15, Peshawurees, residence in the Bazar-i-Bazaran; Snuff-sellers 45, Kashmirians and Peshawurees, who mostly dwell in the Gunj-i-Kohnah; Sugar-refiners 3, Peshawurees, who live in the Bazar-i-Kalan; Smiths 27, who are Peshawurees, and reside in every street and Bazar; 42 Sherbet sellers, Peshawurees, scattered in all parts of the city; Tailors 10, who are Peshawurees and Kashmirians and have no particular place of residence—such a small number of this class appears strange, but the reason is that the women make their own clothes and also the clothes for their husbands and families, therefore Tailors are not much

required: the women also take in work as in England, and are very industrious. There are also 4 Timber merchants, who are Peshawurees, and reside in the Chouk (market place)-i-Nusseer-Khan; and lastly 13 Tent-makers, who are Peshawurees also, and have no particular place of residence. The inhabitants of the city are a mixed race, consisting of the people called Peshawurees, who do not pretend to trace their descent; Hindus of the Kutree and Seik tribes, Kashmirians, Affghans, and Moguls, but the latter are very few in number.

The principal streets and Bazars are as follow:—The "Bazar-i-Kissah Khoane" or "Street of the Story Tellers," immediately inside the Kabul Gate, is the most lively part of the city, more particularly about sunset, when it is crowded with all sorts of people. At this time the din is so great that it is impossible to hear one's self speak. Here may be seen Affghans and English, Kashmirians and Panjabees, and Armenians, Huzaras and Hindoos, and Parsees—old and young, rich and poor, all crowded together and elbowing each other on all sides. Here Officers on Elephants and Horses, there Fakeers on Ponies,—one fellow crying out "Garam Nam" (Hot Bread), and another striking two brass cups together, which produces a vile sound, and crying out "Sard Ab" (cold water), cows, donkeys, camels, dogs, sheep, goats, buffaloes, men, women and children, all mixed up in one great moving mass. The whole of the houses of this street have shops on the ground floor, whilst the frail fair ones" reside above. The next street is Jehangeerpurah, which is the residence of Moguls, who are few in number, Kashmirians, Peshawurees, and Affghans. "Duma-Gullie," or the "Street of the Minstrels," now principally occupied by proprietors of Dancing Girls and Prostitutes. Mhowree Mahalah, inhabited by a few Moguls of the Mhowree tribe, and Kashmirians. Meerpurah, inhabited by Peshawurees. Gunj-i-Khonahar, old Grain market, which is a very large quarter, and is inhabited by Peshawurees, Kashmirians, and a few Moguls. Keerumpurah, in which Hindus chiefly dwell, as also a few Peshawurees. These two latter streets, together with that of Jehangeerpurah beforementioned, have each a Bazar of their own, which is entirely independent of the city Bazar, or as it is called the Bazar-i-Shair, which extends from the Kabul Gate to the Gorkhutree. The next street is that of Gorkhutree, mostly inhabited by Peshawurees and a goodly number of Hindus. Mahalah-i-Nalbandan or Street of the Horse Shoers, in which Peshawurees reside, as also a few "Dums"

or Singers, who are not considered to be of any tribe or caste. Next is "Ander Shair," or "In the City," in which the Seiks and Khutrees of large property, such as Bankers, Drapers, Silk-manufacturers, and Merchants, reside.

The principal Streets in the Suburb Sir Assea are the Mahalah of Sir Assea, which has a large Bazar of its own, also independent of the city Bazar, and inhabited by Peshawurees. The Mahalah-i-Kaharan, which is inhabited by Hindus, both Kutrees and Seiks, and is the only other Street of consequence in this suburb.

The next objects worthy of remark, as regards the city of Peshawur, which are eight in number. There are three principal ones, the best of which is in the Bazar-i-Kissah Khoane, near the bridge on the left, going towards theKabul gate; the others are, one near the Pul-i-Sungee or Stone Bridge, the other at the Gorkhutree. The Baths are kept exclusively for females from daylight until about 9 o'clock A. M. and after 4 o'clock P. M. : between these hours they are available for the other sex. Such is the custom in the cold weather : in the hot season the women bathe at home, and the men frequent the baths of the different Musjids, which are nearly all provided with shower baths. The operation at the Humums is as follows :—On going in, after undressing, a clean piece of cloth, about three yards long and one broad, is given to the victim to wrap round his loins, after which the barber of the bath, as he is called, makes his appearance with a bowl in his hand, and takes him to a large reservoir of hot water, which is poured over him until the body is sufficiently moistened. A cloth is then spread on the marble or chunam floor, and another cloth is rolled up in a peculiar manner, to form a pillow for the head. The victim is then requested to lie down on his back, and the barber commences a series of manæuvres, consisting of thumps, slaps, pinches, &c., after which the wretched individual is turned now on this side, now on that, the slaps sounding like the report of a gun. The legs and arms are then turned and twisted about, and all the joints cracked; after which the operator seizes a rough sort of glove, in roughness not unlike the curry-comb used for horses. With this the outer skin is rubbed off, during which time the operated one is half drowned by repeated doses of hot water. After this is done, the operator commences to wash him with soap. After which, if he pleases, the victim can be shaved: this over, a few more doses of hot water conclude the operation. A dry towel is then given and a fresh cloth to tie round

the loins; after which, the victim, aching in every limb, retires to the dressing room. The ladies have to undergo a similar operation, but the operator is, of course, of the same sex. The price for all this pleasure and enjoyment is a quarter of a rupee, but varies according to the rank of the party who undergoes the operation.

The city of Peshawur is bountifully supplied with water, and the greater number of houses have wells attached to them. Several wells are celebrated for the coldness and purity of the water, the coolness of which continues throughout the hot weather. Several accounts of these cold wells have been written, and published too, I believe; but I fear some of these writers have been bamboozled by the Peshawurees, who are fond of playing off such tricks on persons who do not understand their language. In the first month of the winter season, the wells, after being cleaned out, are filled to the brink with water from the Bara river, which flows into the plain from the Khaiber range of Teerah; after which they are roofed in with brick, and remain closed until the commencement of the hot season,—a period of six months,—after which they are opened. For the first three or four days the water remains untouched, to allow the bad smell, occasioned by being closed for so long a time, to pass off. For the next ten or fifteen days the water has a putrid taste and unpleasant smell, but after that period continues to improve daily, both in purity and brilliancy; and the water moreover continues so cold throughout the hot season that it is almost impossible to quaff a tumbler full of it at a draught. The Chah (well)-i-Shaik Iwuz (a celebrated devotee mentioned by Mr. Elphinstone,) which is situated in the suburb of Sir Assea, is the most celebrated.

Another sunk by Yar Mahomed Khan, brother of Sultan Mahomed, and called the Chah-i-Sirdar, is situated near the Kohaut Gate. A third is situated in the Bagh-i-Wazeer; and a fourth has been lately sunk, but is not so famous.

One or two authors have written concerning the "numerous mosques and other public buildings of Peshawur, many built in a splendid style of oriental architecture, now going to ruin." At the present time no trace remains of these, I fancy, imaginary buildings, and the mosques (six in number) that are at all worthy of even the slightest notice, are small and meanly built,—in short much meaner in appearance than the Musjids of many villages in Sindh and the Punjaub. The largest is the Jama Musjid, the minarets of which are conspicuous objects in

the landscape: it was built by a Mahabat Khan, Affghan, in the year 1756. It is of tolerable size but is very much delapidated, and bears no trace of ever having been built in a "splendid style of oriental architecture."

There is one well built Mosque in the Suburb of Sir Assea, called the Musjid of Seik Iwuz, close to the cold well called after that devotee; and is far superior to anything of the kind in the city. It has been built since Mr. Elphinstone's visit, and is of small size, but constructed in the most substantial manner, and is entirely white.

Respecting the derivation of the name "Sir Assea," or "The Mill Head," it is said that the first mills in the district were erected here. In the Province of Peshawur, and in many parts of the Punjaub, the corn mills are turned by water. Another tradition is, that the proper name is "Sir Assa," from Assa a crutch, and that the crutch of the Caliph Ali is buried beneath the cupola of a shrine in this Suburb, to which, on this account, both Sheah and Sunni came to pray. From the cupola of this shrine also an iron chain hangs, which is customary in several Musjids and Zearats—why, I cannot discover. In this Zearat or shrine to which I refer, the chain at present is about 12 feet from the ground, and it is said that formerly it could be reached with the hand, but since the infidel Seiks made their appearance at Peshawur, it gradually shortened, and continues to do so still. The most considerable public building is the Gorkhutree, formerly the residence of the Seik Governor. It was formerly a caravanserai, erected at the orders of Nurjehan Begum, wife of Jehangeer. It is in the form of a square, 700 feet in length, and the same in breadth. One side is occupied by buildings, containing large and spacious rooms, which during the time of the Seiks were the residence of the Governor of the Province; and contained numerous offices for the use of the different departments of the Government, built by General Avitabile in the Hindu style. It is ornamented, both inside and out, with grotesque figures, painted in the most brilliant colours, in a similar manner to the embellishments of most Hindu Temples. It was at first called the "Serai-i-do-dur," or "The Jun of the two gates," and after the death of its founder was allowed to go to ruin, in which state it remained; when a Jogee or Hermit took up his residence there close to the well. This Jogee in a short time became so famous for sanctity that votaries flocked to him from all parts. This at length increased to such an extent, that, being greatly

annoyed thereby, he one day jumped into the well and disappeared. He was not lost, however, for it is said that he came forth at a spring some two miles distant, and near the Zearat or Shrine of Ghazee Mard, N. E. from the present cantonment. Hindus, both Khutrees and Seiks, in great numbers, visit this place on Sundays and Wednesdays, more particularly on the former day, when they go there to pray, and bring back some of the water for their children to drink.

After the Jogee left Peshawur, the people were in the habit of carrying off the bricks of which the Gorkhutree was constructed, for building purposes; until about nineteen years since, during the time that Sirdar Sultan Mahommed Khan held the province, one Suyed Ahmed, a celebrated fanatic (of whom more hereafter,) arrived at Peshawur, with a body of Eusufzai Affghans, and, after defeating Sultan Mahommed Khan, took up his residence in the Serai, and caused it to be repaired. The name Gorkhutree was given to it, from the mound on which it stands bearing that name. There are three other caravanserais in the city, viz., two in the "Gunj-i-Noh" or "New Grain Market," and the other, which is the largest of the three, is situated to the right of the Gorkhutree Bazar. The first is called the "Serai-i-Jahafan" "or the Serai of the Bookbinders"; the second Serai-i-Datamull, for Sugar, Ghee, Oil and Ghoor; the third the Serai-i-Sulliman. The first and last mentioned are frequented by Mahommedans, the other by Hindus. These places are all built of unburnt bricks, and are without any pretence to ornament whatsoever.

With the exception of the former town residence of Sultan Mahommed Khan, there are no other buildings within the city which call for a passing glance, its extent being the only importance. None of the fine residences mentioned by Mr. Elphinstone are now to be seen—not even a trace remains.

Outside the City to the South lies the "Bagh-i-Wuzeer," or "Wuzeer's Garden," distant about three quarters of a mile. The site of the present building was formerly occupied by the summer-house, built by the celebrated Futtih Khan, Wuzeer of Mahommed Shah, who laid out a large sum of money on the garden, which has been a very delightful place, and still contains a great number of beautiful cypress trees, so much cherished by the Mahomedan, and

furnishing him with the emblem of the upright stature of his "Ladye Love." It fell into disrepair until the period when Peshawur fell into the hands of the Seiks through the treachery of Sultan Mahommed Khan, who on his return from Lahore erected the present building, on which, and the gardens, he is said to have laid out 80,000 Rupees. It is a picturesque building, containing apartments for his numerous Harem; it is called the Bara Duree of Sultan Mahommed Khan.

On the north side of the city are the ruins of another garden house situated in what is called the "Shahee Bagh" or "Royal Garden," but it is of small dimensions, and the garden is uncared for and neglected. In it formerly stood a splendid residence, erected by Timur Shah, but after his time, both it and the garden were neglected: when the province fell into the hands of the rapacious Seiks, they ordered the beautiful trees to be cut down, and the garden was turned into a corn field. To complete the destruction, the people of the city carried off the bricks, &c., for building purposes. The summer house, at present there, was erected by Sheer Singh, the son of Runjeet, during his residence at Peshawur.

To the west of the city, distant about half a mile, is the place known as the Garden of Ali Murdan Khan, a nobleman who lived in the reign of Baber, and who has perpetuated his name in various parts of Affghanistan and the Punjab, by the buildings constructed by him. This place, which is of some extent, is surrounded by a wall with corner towers, and has two gates. The Residency now stands on the site of the Garden House erected by the nobleman above mentioned. It is, as might be expected, a large and substantially built house, the lower parts of which are used as offices, and the upper occupied by the Deputy Commissioner of the Province and his friends. Numerous buildings surrounded this Residency, which are chiefly occupied by the Assistants of the above official and the Officers of the Punjab Local Corps quartered at Peshawur. There are several Zearats or Shrines round the city. The principal is, the Zearat of "Panj Peer" or the "Five Saints," about a mile or more to the south east of the city. It is visited on Friday nights by great numbers of people. In the summer, the Prostitutes go there in the day time, and at this season also, a sort of fair is held weekly, at which people from all parts attend. The unfortunate females above alluded to have a strange custom of

frequently visiting shrines and places where Devotees are buried; and on the nights of Friday, in particular, they attend to dances at the different shrines, which they consider a religious duty.

The next shrine is that of *Akhund* Durweza Baba, also to the south east, and two others to the south—that of Suyed Hassan, and the other of Shaik Hubeeb. In this latter place lie the remains of Sirdar Yar Mahomed Khan, brother of Sultan Mahommed, son of Surafraz Khan, and therefore brother of Dost Mahommed of Kabul, but by a different mother; Shaik Iwuz, the devotee before mentioned as the friend of Mr. Elphinstone, and most of the principal people of Peshawur.

The Balla Hissar, or fort of Summerghur, alone remains to be mentioned. It occupies the site of the old Balla Hissar, which was almost entirely rebuilt by Shah-i-Zeman, who added to it a Hall of Audience, Zenanah, and various other buildings, as also a fine garden, called the "Shalah-i-Mah," or the "Light of the Moon." It was in this residence that Shah Shujah received Mr. Elphinstone. From the time that the Barakzai Sirdars obtained possession of the country, it went to ruin, and on account of the hatred between the Barakzais and Suddoozais, the royal tribe, it was not repaired. When the infidel Seiks got possession of the country, they completed the destruction begun by the Barakzais: they destroyed the garden, and cut down the beautiful trees, which they used for firewood. The present Fort was erected by Sheer Singh, the son of Runjeet, at his father's order, and in consequence, whatever remained of the old Balla Hissar was razed to the ground. It was built mostly of unburnt bricks, and is rather imposing in appearance; but of no great strength. It might have held out for ever against any force that the Affghans could have brought against it during the late Campaign.

Attak is nothing in comparison to it: if Attak could have held out so long, surely Peshawur could have done the same. It has two walls with corner bastions, and others of a smaller size between. The outer wall is about 25, and the inner wall about 75, feet in height, and commands the city, from which its south-west angle is distant 60 yards. It is surrounded by a dry ditch of no great breadth or depth, and several of the embrasures are faced with mortar or chunam. The situation is almost due east and west, with the entrance to the north. It contains magazines and a few other buildings, which are mean in ap-

pearance, and of but little consequence. The height of Dakhee, just outside the Kabul gate, in the possession of an energetic enemy would cause great annoyance to the garrison.

THE DISTRICTS OF PESHAWUR.

The Province of Peshawur is divided into six Tuppahs or Districts, each of which is inhabited by a separate tribe, who are quite independent of the other. These Tuppahs are Doabah, Hashtnuggur, Khalisah, Daondzai, Momund, and Khulleel. The four last are round about the city, the two former are on the opposite side of the Kabul river.

The Tuppah-i-Doabah is so called, from being situated between two rivers, which its name implies, viz. the Lundye, or as it is sometimes termed the river of Suwat, and the Kabul, which latter stream on its entrance into the plain from the Khaiber mountains, separates into three streams, viz. the Shahallum, the Naguman, which is the main stream, and the Addozai: these two latter belong to the Doabah. These rivers, therefore, are of great advantage to the district, and which is not overlooked by the people. The canals are cut in every direction for the purposes of irrigation, and are very numerous. The villages situated near the banks of the Lundye, are numerous, and well peopled; but on approaching the mountains to the west, the villages are much smaller, and the inhabitants much fewer in numbers. The soil is for the most part sandy, whether near the mountains or near the rivers, by reason of which the houses are built of wood and canes; for the soil will not admit of being made into bricks. The ground is also marshy in many places, in which these canes or reeds flourish in the greatest luxuriance, and are used at Peshawur for building purposes, besides being made into mats and other articles. The inhabitants of the district are of the tribe of the Gigyanee, one of the large clans of the Affghans, and said to amount to 20,000 souls. There are a few Hindu shopkeepers, and a few Peshawurees, who are cultivators of the soil.

The principal towns are, Shabkadir and Batgiram. The town of Shabkadir, which is about a mile distant from the Fort of the same name, contains about 400 houses; but on account of the Fort being occupied by a strong garrison, a thriving town has sprung up around it, and the town of Shabkadir has consequently suffered thereby. Many of the dwellings are in ruins; and the number of inhabitants does not exceed one thousand.

The Fort of Shabkadir is situated on a natural mound, of no great elevation; and contains an area of 660 yards, and the walls are about 45 feet in height. It is octagon in form, and has eight bastions, with a tower or keep in the centre, and is built of mud and sunburnt bricks. A thriving town named Derauj, stands to the south of the Fort, with which it is connected by a wall of about 8 feet in height, in an unfinished state. The entrance to the Fort is on the town side, which latter has two gates. It contains about 1000 inhabitants, and has a good Bazar, containing 150 shops, the whole of which are kept by Hindus; the houses are small, and built of mud. A rivulet from the river Addozai, runs past the north side of the Fort, and two other rivulets flow by its eastern side, where there is the residence of a Fackeer or Devotee, and around which there are a few mulberry trees. The revenue of the town and fields belonging to it, amounts to 9,000 Rupees. Batgiram, which is the larger town of the two, contains about 2,500 inhabitants. It is also known by the name of the "Shair-i-Doabah," or the "City of Doabah," from its size. The houses are built chiefly of very small stones, and are thatched with canes. It is intersected by several rivulets, and yields a revenue of 21,000 Rupees: a small police force is also stationed here. The other principal places are Kangra, Serekh, Murouzai, Dalzak, Mogul Khail, Nesrutzai, Sokhtah, Panjpow, Apkai, Adeczai, and thirty-seven smaller villages.

The Tuppah-i-Hashtnuggur is also called from eight towns of the district, which are much larger than any others in the province of Peshawur. Many people imagine that these eight towns are close to each other: if I mistake not, it is so mentioned in Thornton's Gazetteer; but it is not the case. The eight towns are Char Suddah, which, together with Prang and the village of Kazeckhail, form the present Hashtnuggur; Ruzrr, Atmanzai, Tungee, Sheerpon, Abazai, and Nohshaira. The district extends for about four miles along the bank of the Suwat or Lundye river; beyond which, is the country of the powerful and numerous tribe of Eusufzai. The inhabitants of the district are Mahomedzais, a branch of the great tribe of Dooranee. Irrigation depends mostly on rain; but the Palez, or vegetable crops, are cultivated near the banks of the river, where water can be obtained easily: the greater elevation of this Tuppah above the level of the water of the Lundye, prevents its being made use of for the purpose of irrigation at any distance from the banks.

The towns of Char, Luddah, and Pranj, which, with the village of Kazeekhail, form the present Hashtnuggur, are close to each other, and contain about 7,500 inhabitants. The houses are mostly well built, both of kiln-burnt and sun-burnt bricks, and are from two to three stories in height. They have a large and well supplied Bazar, and carry on a thriving trade. The number of shops is about 500. The greater part of the produce of the Eusufzai country is brought here, and great quantities of sugar cane, (the produce both of this district and that of Doabah) are made into Goor, a coarse kind of sugar, which is sent to Peshawur. This place is the largest in the province, after Peshawur. The ruin known as the Hissar of Hashtnuggur, is properly called Æsar, and is separated from the town by a branch of the Lundye river, which at Tungee divides itself into three branches, which again, after flowing in this manner for about eight miles, unite a little below the Fort. It consists of a high mound, fifty eight yards in length, and about the same in breadth, and is visible from an immense distance. The people of Hashtnuggur have erected walls of stone and mud on the summit of the mound, with towers at the corners of the same materials. There are numerous trees around, consisting of Orange, Lemon, Mulberry, Peach, &c. The revenue amounts to 27,000 Rupees. The next town of consequence in this district is Nohshaira, which contains a population of 5,500 souls. It is called Nohshaira, which means nine towns, from the inhabitants being of nine different branches of the Mahomedzai, descended from nine different ancestors. They are as follow:—Abakhail, Matahakhail, Baramkhail, Shurakhail, Khanowkhail, Barakhail, Shahhussaine, Anthekhail, and Markhail. The Barah branch first settled here in the time of Timur Shah, who also gave them the lands for military service; but on being joined by eight other branches of the tribe, the name of the village was changed from Barakhail to "Nohshaira" or the "Nine Towns." There are many large and well built houses in the town, but the greater number are built of large clods of earth, dried in the sun. The fields are irrigated by means of wells, the water from which is distributed by the Persian wheel, and by the rain. The water of the river is not made use of except for the vegetable crops, which are generally close to the river banks. To the east of the town is a wonderful grave, which is twenty eight yards long, known as the "Kabur-i-chel Guz Baba," or (literally) the "Grave of the Forty yard Father." The people say

that it was there previous to the arrival of the first settlers. There is a similar one to the west of the town, also of the same size, and called by the same name. People from all parts come to pray at these graves, but whose they are, I could not discover; I did not even hear a tale concerning them. North of the town, about a mile and a half distant, a limestone range of hills, of about 300 feet in height, rises abruptly from the plain, near which the battle (or massacre) of Nohshaira, took place between Runjeet Singh and the Eusufzais. To the south, and on the opposite bank of the Kabul river, stands a small mud Fort, built by Avitabile, to keep open the communication between Attak and Peshawur. A small village stands near it, which has a bazaar, the shopkeepers of which reside there all day, but return to their homes at Nohshaira in the evening. The other principal places of this district are Nicetta, (Niccea), Trungzai, Omarzai, Turnab, Meerzadair, Dagai, Sheerpow, Chuttah, and twenty-six other villages.

The Tuppah-i-Khalissah, lies directly east of Peshawur, and is watered by two rivers, viz., the Jundee, and the Turnow; which, nearer to their sources, are respectively called the Bara and the Khurr-i-Momund. The district contains people of so many different tribes that I am unable to say which are greatest in point of numbers. There are Khulleels, Daondzais, Momunds, Aorrmorrs, Hindkeels, &c. &c. All those that are of pure Affghan descent, speak the Pushtoo language; but those of mixed blood, such as Hindkhees and others, speak Punjaubee.

The principal towns are Chumkunnee, and Pubee. Chumkunnee is the prettiest, and with the exception of Hashtnuggur, the largest, town in the province; and contains 5,000 inhabitants. It is distant from Peshawur about five miles to the eastward. It is inhabited by Momunds and Peshawurees; the Malik, or chief man of the town, is of the former tribe. It has a large and well supplied bazaar, containing about 150 shops; the town is watered by two rivulets, and is surrounded by trees and gardens, containing Peach, Pear, Plum, Mulberry, Pomegranate, Quince, Ber, Grape, and other fruit-trees. There is a shrine near the town, called the Zearat of Mean Sahib, to which people flock from all parts; there is also a large and well built Musjid.

Pubee, the next place of consequence, contains about 750 inhabitants. It is the first encamping ground for troops after leaving Peshawur. The country round is well wooded, but the trees are of the

Tamarisk. The soil is barren, and contains great quantities of nitre; the cultivation is therefore scanty: the revenue is 1,500 rupees. About three miles from Pubee, low hills rise, which gradually increase in height, and form that range which constitutes the South-Eastern boundary of the Province. The soil to the south and west, to within 12 miles of Peshawur, is very barren, and intersected by ravines and patches of coarse black sand, and is also marshy in many places. The other principal villages are Jehangeerabad, Wuzeerabad, Meerpurah, Lerbulundpur, Pannogurrai, Kalookhail, Timurpurah, and thirty-one others of smaller size.

Tuppah-i-Daondzai.—This district lies directly north of the city, and is very marshy in many places. About a mile distant from the fort is a morass, two miles long by as many broad. These bogs are entirely unsuitable for cultivation; but the people send their cattle to graze in them, and great quantities of canes are produced, which are used for building purposes. The district is watered by two rivers, viz., the Shahallum, and the Sarmahwulla, which is here called the Budnee. Like the Khalisah district, it is not entirely peopled by the Daondzai tribe, as the name would imply. The villages are small in comparison with those of the other districts, but they are very numerous. Shahallum is the largest village, or town it may be called, and contains 1,000 inhabitants; the revenue is 12,000 rupees. The next most important places, are Khudderkhail, Hassunabad, Murut, Baboozai, Gurrai-i-Sahibzadah, Gurrai-Fazil, and fifty-six others of smaller size.

Tuppah-i-Momund.—This district extends from the city, in a south westerly direction, to Shekan on the Bara river, and from Peshawur to the range of mountains to the South East. It is watered by the Bara, and the river here called the Khurr-i-Momund; but which, after passing Peshawur, is called the Turnow. It rises in the Afreedee mountains, as does also the Bara or Jindee. The largest towns of this district, are Budabeer and Mashookhail. The first mentioned place contains a population of 1,500 inhabitants. Two or three rivulets, branches of the Khurr-i-Momund, run through the town; and their banks are shaded by numerous trees of various sorts; the revenue of the town, and fields belonging to it, amounts to 9000 rupees.

Mashookhail contains 1,300 inhabitants, and yields a revenue of 7,000 rupees. The other villages of importance are Mittnee, Shekan,

Azakhail-i-koh-i-Daman, Mushtoozai, and eighteen smaller villages.

Tuppah-i-Khulleel.—This district, which is the smallest of the six, lies directly west of Peshawur, and is inhabited by the Khulleel tribe, who are particular friends of the Khaiberries; and receive a share of whatever these last mentioned people manage to steal from Peshawur and its vicinity. Being situated close to the foot of the Khaiber range, it is less cultivated in proportion than the other Tuppahs. It is, in fact, entirely barren where the water of the Bara river, of which the Khulleels receive one share, cannot be brought into play for the purpose of irrigation. Tahkal is the chief town of the Khulleel tribe, and contains 1,200 people. It has four Musjids, bu ilt in a substantial manner, and each has a reservoir of water attached for the purposes of ablution. It is surrounded by a great number of fine trees, but which do not bear fruit. Two rivulets from the Bara river also flow through the town: the revenue is 8,000 rupees. The other principal places are Takhal-i- Paen, Sir Bund, Nohdeh, Kaffir Deree, Speersang, Pulloosee-i-Tahkarzai, Sungu, Pulloosee-i-Mughdurzai, and sixteen smaller villages. The whole of the villages of this district are well built, very clean and picturesque, and have rivulets running through them, the banks of which are generally shaded with fine trees.

The Fort of Tutlihgur, generally known as the Fort of Jumrood, is situated about three miles from the entrance to the Khaiber Pass. It is small in size, and has a sort of keep in the centre. There are the remains of a small village round it, which is now entirely deserted, and the fort itself is in a ruinous state. The village of Jumrood, also in ruins, is half a mile nearer the Pass.

THE EUSUFZAI COUNTRY.

The part of the Eusufzai country which at present forms a portion of the Province of Peshawur, I had the opportunity of visiting in December last, when my Regiment formed part of a force which left Peshawur for the purpose of chastising the inhabitants of several refractory villages. On the 3rd December 1849, we reached Pubee, and on the next day arrived at Nohshaira, both of which places have been described under the respective Tuppahs or districts. On the 8th of December we left Nohshaira for Toru, our route lying a little to the East of North. The ground as we advanced, sloped gradually towards the North. We passed several villages, near which I observ-

ed small fields of cotton, the inhabitants merely cultivating a sufficient quantity for their own consumption. The cultivation appeared scanty, and the country was almost destitute of tress. The wild "Ber" tree appeared in several places, but never exceeding six or eight feet in height, and its fruit was bitter and unpleasant to the taste. We crossed the dry beds of two mountain-streams. Toru, so called by the Peshawurees, but properly Tola, which means a concourse of people assembled in one place, is inhabited by the Mashranzai branch of the Eusufzais. It consists of three villages, within half a mile of each other, and altogether contains 5,000 people. There is a Bazar in each of the villages, the shopkeepers of which are Hindus, and a few of the Parancha class, who sell cloth, linen, &c. To the north of the town is the dry bed of a river, here called the Lundye; which, in Affghanee, means a mountain stream: its proper name is Nalah-i-Hind. It was dry at this time, but comes down with great force in the hot season—so the people said. The revenue is 17,000 Rupees, which they say is too much, and more than they can afford to pay.

The country between Toru and Hamzah Khan, the next halting-place, was similar in appearance to that passed through on the previous day, and mountains rose on three sides. The towns of Ootey and Mardan lay in our route, about a mile from each other, on the right and left of our road. The town of Ootey, which is almost close to the road, contains 2,500 people, and Mardan 2,000. They are held by Meer Afzal Khan, the Arbab or Chief of Toru; and yield a revenue of 11,000 Rupees. After passing these, we came to the small village of Fatima, which belongs to the town of Ootey. The ground continued to slope towards the north, and trees were numerous. Two ranges of mountains rose to the north, and on the east low hills ran in a south-west direction. Hamzah Khan is a small village, surrounded by a deep trench, and contains 150 people, consisting of Suyeds, Fackeers, and a few persons of the Meeankhail tribe. They may have fields at a distance, but there was no sign of cultivation near it. The mountain of Kathamar, near a village, to the East of which is a stone or slab, called by the name of the "Sang-i-Newishtah," or the "Inscribed Stone," is distant from this village about 12 miles to the East: a hollow near the top of the mountain is also plainly visible to the naked eye. The character written on this "stone" is unknown, but supposed to be Greek. I had asked for leave of absence once or twice, during my stay at Peshawur, for the purpose of visiting this and other interesting places, but the authori-

ties pronounced it highly dangerous, so leave was refused; although, at the same time, I would have ventured into any part of the country. I have tried to get a copy of the character on the "stone," but without success. There is no doubt but that there are numerous remains of antiquity in this part of the country; and it is here we must search for the rock of Aornos, and the cities of Ora and Beziza, mentioned by the Greek Historians.

There are two roads from Hamzah Khan to Katlung, the next march one leads to the right, and the other to the Hill of Chechar; that on the left only is practicable for guns. The road to the right leads to the Hill of Chechar, the road leading to the top of which appears in some places to have been built up, and in others to have been hewn from the solid rock. The summit of the Hill consists of a space of ground 400 yards long, by 100 yards in breadth, and is covered with the remains of buildings built on platforms. One in particular, the largest, consisted of a raised platform of about eighteen feet in height, and sixty square. On this stands what appear to be the remains of a Temple, and the whole place was strewn with carvings of men and elephants in different positions. The buildings are constructed of a bright yellow coloured soft stone, whilst the carvings are all in slate. Since the time I saw the place, several figures, as large as life, and extremely well executed, have been dug up. They are of a white composition, something similar in appearance to plaster of Paris. One of these figures has, I believe, been forwarded to the Governor-General. The ruins are evidently Bhuddish. The plain at the base of this hill is entirely covered with a forest of wild ber and other trees.

The town of Katlung is built on three sides of a small tank, and contains about 1,500 people. This tank is formed by the stream which runs past the town, and is bordered with fine trees, which the people call the Adrak and the Mayar, as also a few Ber and Mulberry trees. The inhabitants of Katlung are Khuttuks, who have been settled here for a long time: several other villages in this valley, as it is termed, are inhabited by the same tribe, and will be hereafter enumerated. Some say they are of a different tribe to the Khuttuks south of Peshawur, and that they are one of the various tribes of the Eusufzais. The revenue of this town is 600 Rupees; the cultivation is scanty.

On the morning of the 11th December, we reached the village of Ameer Khan, which is distant from Katlung eight miles. It contains a population of 500 souls, of the Shaberkhail Eusufzais. The houses are built of stone. The revenue is 180 Rupees. About five miles to the east of this village, at the foot of the mountains which separate this part of the country from Booneer, lies the village of Abazai. The highest part of these mountains is called the Koh-i-Rama, near the summit of which there is a cave, called the Issmus-i-Kashmir, and which is said to lead into Kashmir. The mouth of the cave is about six or seven yards wide, inside which are a great many carved figures: to enter is difficult, on account of the immense number of Flying Foxes. The village of Sangawe or Sugow, which was captured and burnt, is situated in a narrow gorge of the mountains, and contained 70 houses, which were built of stone and mud. To the left of the village lies the road into Booneer, which is very steep and narrow, and from which reason it is called Tungee. The inhabitants amounted to about 350 persons, who were of the Shaberkhail tribe. The country between Sangawe and the village of Pullai is entirely uncultivated, level, and here and there intersected by ravines and beds of mountain streams. The camp was pitched about three miles from the insurgent village of Pullai, between the hill of Tarakai, and the dry bed of the Kalpanee river, or, as it is generally called, the Khurr-i-Lundye: there are no villages within a mile or a mile and a-half of this place. In the valley, in advance of us, were situated the villages of Pullai, Zormundai and Sheerkhanee, which were burnt, and three others, further up the valley, called Bazdarrah-i-Paeen, and Bazdarrah-i-Balla, together with Mora, which is situated half way up the mountain on the road into Suwat. The valley, which is known as Bazdurrah, is about six miles in length, and from three to four in breadth; it was well cultivated and well wooded. The three first mentioned villages were built of stone, and two were surrounded by walls, with round towers of no great height at the corners. The number of inhabitants in these several places could not have been less than 5,000 souls.

The country between Katlung and the hill of Chechar, is called the plain of Lundye Khan; that between Chechar, Sungawe and Pullai, the Babazai valley; and that between Pullai and Suyedabad, the plain of Lundye Khurr also. The principal villages are Ameer Khan, Sungawe or Sugao, Kowai, Baboozai, Peepul, Hadjee or Ghazee Baba,

Ousmankhall, Burmuwull, and the villages situated in the Pullai valley before mentioned, held by different tribes of the Eusafzais; and Kassamai Kalloo, Panai, Deerai, Katlung, Chirchor, Lundyekhurr, Meeah Issak, Hallur, Dundeah, Shimunzai Guzr, and Matah, the whole of which are inhabited by Khuttuks, whose villages are mostly in the Lundye Khurr valley.

On the 16th December, we reached the small and miserable village of Suyedabad, inhabited by about 100 Suyeds; it belongs to the village of Hamzah Khan, which is distant from Suyedabad eight miles. The country round about this place is flat, but little cultivated, and the villages are at great distances from each other, except in the neighbourhood of the mountains, the little retired valleys of which the Eusufzais seem to prefer for the sites of their hamlets.

To the west of Suyedabad, and about a mile distant, is a range of hills, rising abruptly from the plain to the height of six hundred feet or more. It is named Bihee, after one of the sons of Raja Seetah, who held Peshawur previous to the conquest of the Province by Mahmood, the Ghuznevede. Bihee held the government of this part of the country, as already mentioned.

The summits of this range are covered with ruins of various sorts and dimensions; but they are so fresh and sharp in appearance, that one would suppose they had not been erected for a year. The Southern part, which is the highest, is covered with an extensive ruin, called by the people of the country the "Takht" or "Throne of Bihee." About the centre of the hills to the West, there are the ruins of a Temple, or something of the kind, on a very large scale; and the remains of a great number of pillars, of a curious shape, and hollow inside: the place was overgrown with bushes and weeds. The stone of which all the ruins are constructed, is of a bright yellow colour, soft, smooth to the touch, and breaks into flakes. The blocks of stone are merely squared on the inside and outside, the interstices being filled up with the same stone; but so exquisitely, that it would almost lead one to imagine that the stone had been used in a melted state, and had turned into stone, exact in appearance to the other blocks. From what I have mentioned respecting the blocks of stone being merely squared inside and outside, it must not be imagined, for a moment, that these buildings were either roughly or clumsily constructed, for the workmanship is beautiful; and the whole seems

to have been the work of a people as well versed in the science of architecture, if not better, than we are at the present day. The whole of the range of hills on which these ruins lie, is composed chiefly of slate, containing veins of quartz and limestone, which form the composition of the mountains round about. With the exception of a well, at the bottom of the hills to the west, there are no signs of water nearer than the village of Suyedabad, close to which the stream of Kalpanee or Khurr-i-Lundye flows. The well referred to is cut out of the solid rock, with steps leading into it. When I visited the place it contained but a small quantity of water, which was bad tasted and of an unpleasant smell. The hills and country round were destitute of trees, with the exception of a wild Fig and a Ber, which grew at the side of the well.

The hills around Pullai were covered with similar ruins, to all appearance, as those at Chechar and on the hills of Bihee, but did not seem nearly so large. The architecture bears no similarity to the Greek style, and the people of the Country say that they are the remains of Kaffir cities, with which the whole of the surrounding country is covered, more particularly Suwat. I have no doubt but that valuable and important discoveries might be made at Bihee and other places, in this part of the Eusufzai country, at the sacrifice of a very little trouble and expense.

The next march brought us to Hashtnuggur, which has been already mentioned in the account of the Tuppahs or Districts of Peshawur.

RIVERS OF THE PROVINCE.

The Province of Peshawur is watered by several rivers, all of which, with the exception of the Kabul, are but small streams, although of great importance to the country.

The Kabul river, on entering the plain of Peshawur from the Khaiber mountains at Michnee, separates into three branches, called the Adozai, the Nagaman, and the Shah Allum, the first mentioned being the northern branch. These flow five or six miles apart as far as Dobundee, where they again unite. The river here receives the Lundye or River of Suwat, and the three minor streams, the Sarmawalah or Budnee, Bara or Jindee, and the Khurr-i-Momund or Tornow, which flows into the Shah Allum branch a little above the village of Dobundee. At Nohshaira it receives the Kalpanee or

Nalah-i-Hind from the north, and falls into the Indus a few miles north of Attak.

The Nagaman, (unsuspected) which is the main stream of the Kabul river, in the months of June, July, and August, rolls along in a deep and rapid volume, and is almost impassable—the passage is effected by means of rafts. In the month of December last, the river was unfordable for troops, and was then a clear and rapid stream, about 150 yards broad; the Adozai, at the same period, was breast deep; and the Shah Allum, at the ferry, nearly four feet in depth: each of these branches was clear and rapid. After uniting at Dobundee the force of the stream is not so great, three or four miles an hour being the maximum of its velocity. At Nohshaira, in the month of December the river was about two hundred yards broad, and is at all times unfordable.

The Lundye, or river of Suwat, which rises in the mountains of Hindu Kush, was, in December last, breast deep, rapid clear and about 100 yards broad: in the hot season it is unfordable, very rapid, and about 200 yards in breadth.

The next river in point of volume is the Khurr-i-Momund, or Turnow, which rises in the Afreedee Mountains South West of Peshawur. It is of no great breadth, and is always fordable. A great deal of water is carried off by canals, for the purpose of irrigation, and in the hot season is about 25 or 30 yards broad. It is called the Khurr-i-Momund until it reaches the Khalisah districts, when it receives the name of Turnow.

The Bara river rises also in the Afreedee mountains and flows in a small but clear and rapid stream until it arrives near the Momund Village of Shekan, where it is divided off by canals into three portions, one of which goes to the Khulleels and the other two to the Momunds. The water of these different canals is again subdivided, so that the bed of the river is at all times dry or very nearly so, until it passes the city, when the channel again receives the water of the various canals and rivulets, two of which latter run through the city, and thus united, join the Shah Allum after receiving the Sarmawalah. The Sarmawalah is dry for the greater part of the year, but after heavy rain in the mountains, it comes down with violence, and carries every thing before it. An occurrence of this nature took place during the time the Peshawur force was there. After a

heavy fall of rain of some days' continuance, the bed of the river, which had been selected as the site of the encampment, at once became a scene of confusion and danger attended with great loss of property from the unlooked for rapidity with which the accumulated waters rushed down their channel.

The Kalpanee or Malah-i-Hind rises in Suwat, and, like all mountain streams, is dry for the greater part of the year, but after heavy rains comes down with considerable violence.

CLIMATE, PRODUCE, &c.

The seasons resemble those of other parts of Affghanistan, viz. Bahar, Tabistan, Khazan, and Zimistan, corresponding respectively to our spring, summer, autumn and winter.

The progress of the seasons is as follows. The cold weather commences about the latter part of September, and continues up to the middle of April; and rain falls at least once a week, and often copiously.

Towards the end of May the days begin to be hot, and in June the heat is at its height. This continues throughout the months of July and August, the Thermometer rising at midday to 108° and 100° of Fahrenheit.

About the end of July we were visited by one or two thunderstorms attended with heavy showers, which were doubtless a touch of the Indian monsoon.

The nights throughout this season were comparatively cool, and a person could manage to sleep pretty comfortably by moving his couch into the open air. The temperature abovementioned is not so great as in many places in Sindh, yet it has a much greater effect on the system. Perhaps our not having good houses at the time I refer to, may be the cause of our feeling it to a greater degree. The country remains green all the year round, and taking everything into consideration, I should have no objection to pass many years there.

During the summer, hot winds, and duststorms prevail, but the air is occasionally cooled by refreshing showers. In September the days begin to get co'd, and the nights pleasantly so; but in October blankets are necessaries that cannot be dispensed with, and every breath of air is excluded from the bedroom. In November it is cold, even in the sun at midday, and a fire is indispensible. There are hard frosts at

night, and during the months of December, January, and February, the Thermometer falls down to 30° and 28° of Fahrenheit, and it is not at all an uncommon occurrence to find the water frozen in the basin in the morning. The mountains are clothed with snow all round from November to March, many of which are not more than eight and ten miles distant; and the Peak of Tatara, which is about 2,800 feet above the level of the sea, was clothed with snow half way down its sides in December and January. Peshawur itself, which is in Lat. 34° and Long: 71° 40′, is 1060 feet above the level of the ocean. During the winter months a great deal of rain falls, which sometimes continues for days together; and such is the peculiar nature of the soil, that after heavy rain it is dangerous and difficult to move about, on account of its slippery, and at the same time adhesive, nature. Water remains on the surface for a long time, and the roads are often impassable thereby for days together.

There are two harvests, viz., Rubee or the Spring, and the Khureef or Autumn. In the beginning of December the Rubee crops are sown, consisting of Barley, Wheat and Gram, (cicer arielinum) and the remainder, for this is not all, is sown at the end of the month, consisting of Addes, (Lentil) Mash (sort of bean,) and Muttar (kind of pea,) the whole of which are ripe and gathered in April. After preparing the ground by manuring, watering and ploughing, the Autumn or Khureef corps are sown, consisting of Jowaree-i-Hindee, (Maize) Jowaree-i-Makee, Badjeree (holcus spicatus,) Rice and Cotton. These crops ripen about the middle of November and beginning of December, and after being cleared away, the ground is again prepared for the Spring crops.

The method of separating the grain from the straw is, by constructing a frame work of wood, which is filled with logs of wood and other articles to make it heavy. This turns on a sort of pivot, and is drawn about by oxen. The straw of Jowaree, called Kerby, is the staple food for cattle, and is sometimes used for thatching. Wheat and Barley straw is made into a material called Boosa, which is given to cattle, and is also used for building purposes, mixed with earth. Rice and Badjeree straw is merely used for packing. The corn is ground commonly by mills turned by water. The stones, which are about four feet in diameter, are placed horizontally. The miller either gets one fortieth of the grain he is to make into flour, or he receives an equivalent in money.

Vegetables are grown in the Spring, and consist of many sorts, which are produced in great perfection, consisting of Onions, Garlic, Carrots, Kuddu-i-Abee, (a kind of gourd) Torce, (a kind of pulse) Torce-i-Hindee, (hibiscus esculentus) Kachnal, (bonhimia variegata) Brinjal, Coriander Tœnugric, Spinnage, Lettuce, Karilla, (momordica charantia,) and various others common to India, besides great quantities of Turnips, on which cattle are often fed. The Castor-Oil plant is grown for the oil, and great quantities are extracted from the Mustard plant, and from Sesame seed. The Daisy is common, as also the Violet, here called the "Gul-i-Paighambar," or the "Prophet's Flower," Camomile, Dandelion, Clover, a species of wild oats, and a peculiar sort of heath, called by the Peshawurees "Seejee," which was in full bloom in March and April, and made the jungles look of a bright purple colour every here and there. Tobacco is cultivated to some extent, and Sugar cane also in the Doabah district.

The next crop is termed Paleez, which literally means a Melon-ground, and consists of Cucumbers, Water-melons, another sort termed Dustamboo, and two other species of Melons, peculiar to these regions, called Sirda and Gazma, referring to the period of the year in which they are produced. Rhubarb is also cultivated, and the stalks attain a large size: at Peshawur it is called Rawash.

The fruits of Peshawur are various, and of excellent quality. The season commences with the Alucha, a kind of Plum, which comes in about the end of March, and continues for four months. This fruit is at first yellow, but afterwards turns to red. About the end of April, the Mulberry is fit to eat. There are two sorts, the Semea-Fut or Vermicelli Mulberry, from a fancied resemblance to that article, its fruit being almost white, and about two inches in length; the other Mulberry is much shorter, thicker in proportion, and of different colours, yellow, red and purple: the fruit continues in season four months. The Fig succeeds the Mulberry, and in June is followed by the Peach, which continues in season until August. This fruit is quite as large as that grown at Home, and is almost equal in flavour to the English Peach, and far superior to that produced in India; and with care taken in its cultivation, might be brought to great perfection. The quantity produced is enormous: they sell at a pice each.

The Grape, the produce of the plain of Peshawur, ripens about the beginning of June, and remains in season one month only: it is of small

size, but good flavour. In the month of July large quantities are brought in panniers on donkeys' backs from Teerah, Suffaid Koh, Jellalabad, and Shinwar in the Khaiber Pass. They are very large, often being two inches in length, but slight in proportion, and many of the bunches weigh four and five pounds each: the fruit is of a delicious flavour. They are at first sold at the rate of six pounds per rupee, and towards the end of the season in August, double this quantity can be obtained. The Peshawurees have a custom of half drying these grapes, by which means they are procurable six weeks later than the period above referred to. The Quince ripens in July and August, and is of large size and good flavour, but requires to be kept for a short time.

The Pear is also a well flavoured fruit, and is of two kinds, one quite green, and equal to anything of the kind in England; the other is of a yellow colour, coarser than the former, but still of pretty good flavour.

Apples, both red and yellow, are brought from the Afreedee hills; but they are small in size, very scarce, and with little or no flavour.

Oranges and Lemons are grown in some of the gardens round the city, but in very small quantities.

Pomegranates are produced in abundance; the red sort only are grown in the plain—a white coloured fruit is cultivated in the Afreedee country.

The Ber or Jujube, attains a very large size, both in this province and in many parts of the Punjaub: the fruit is of large size, and well flavoured.

The only fruit which, I believe, remains to be mentioned, is a sort of Sloe, called in Pushtoo "Amluk," which is found in the Hashtnuggur Tuppah, and in the Khaiber: the Blackberry is said to grow in the Khaiber also, but I have never seen it brought for sale.

EXPORTS AND IMPORTS.

Loongies of three different sorts are exported to Kabul and Khorassan. They are manufactured from Cotton, and one kind is edged with gold and silver thread. These Loongies were at first exclusively made from cotton the growth of the district, and were consequently very dear; but within the last seven years, cotton has been imported from India, and the price is much lower than formerly.

There are coarse kinds of cloths called Chaddars, (Sheets) but they are used in the Hummums or Hot Baths only as towels. There is another kind of cloth, striped red and white, about two yards long, and one broad, used exclusively in the baths, and for which purpose it is exported to all parts of Affghanistan. The other cloths are a sort named from the number of the threads contained in the breadth: thus, Char Suddee, Panj Suddee, which means, respectively, four hundred and five hundred threads. This cloth is manufactured up to Hasht Suddee, or eight hundred threads, (the finest) and is used amongst the poor people, who cannot afford to purchase English long cloth; and is exported to different parts of Affghanistan. The other exports are, Snuff to Hindustan, Kabul, and Scinde; Leather, and great quantities of men's shoes, which are well made, and sent to all the surrounding countries.

The Bara rice, which is raised near the Momund town of Shekan on the Bara river, is famous throughout the neighbouring countries; but the quantity raised is so small that it is only exported to a very small extent. It is very large when cooked, and nine grains in this state laid together lengthways, measure one span in length. The price, if old, is at the rate of three seers or six pounds per rupee; while, during the year of production, it sells at the rate of six seers.

The principal imports are, Posteens, Chogas, Barak (cloth made from Camels' hair) Nandah, and Kuduk, (resembling woollen cloth in appearance, but made from cotton) silks, shoes for women; and various sorts of dried fruits, which are all imported from Kabul and Khorassan; Peshmeenahs and Puttoos, the same material as the Shawls from Kashmir; Tobacco, Sugar, Cotton, English Cotton cloths, Crockery-ware, Iron, Tea kettles, and other copper cooking utensils, from India; Timber from Jellalabad; Salt from Kalabagh; Firewood from the Afreedee country; and Tea from Bengal, Kashmir, Kabul, and Bombay.

Although large quantities of grain are cultivated in the province of Peshawur, yet it is not sufficient to meet the consumption; and Wheat, Gram, Addas, Mattar, and Mash, are therefore imported from Chuch Hazarah, north of Attak; Barley from Kohaut; and Rice from Kumer, (the country watered by the Kamah river, north-west of Peshawur,) and also from Suwat.

Every necessary of life is cheap, and on the arrival of our force there in March 1849, two maunds, or 160 pounds, of Barley, sold for a Rupee; 50 pounds of Wheat flour for the same sum; and Rice, according to quality, was procurable at the rate of 6, 12, 16, 26 and 30 pounds per Rupee; and Eggs, Fowls, Meat, &c., at equally cheap rates.

GEOLOGY AND MINERALOGY.

On this subject I can say but little, for I had very few opportunities of making any observations during my short stay. The mountains of the north, the first and lowest of the four ranges visible, and which are the boundary of our territory in that quarter, are chiefly composed of blue Slate, containing veins of Quartz, Limestone, and here and there Micaceous Shale. The hills must also contain antimony, for the people of the village of Sungawe or Surgao, which was captured and burnt, as previously stated, fired lumps of the mineral at us instead of bullets. The mountains near the hill of Kathamar, which form the south-western boundary of Booner, contain Iron Pyrites, of which I have a specimen; these hills are also said to contain Gold. The Khaiber mountains contain Antimony and Lead, and traces of Coal are said to exist at Kohaut. The soil of the plain is a rich dark red mould, but varies a little in the different Tuppahs, and in some places contains a quantity of sand.

THE REVENUE.

The Revenue of the province, together with Kohaut, in the time of the Barakzai Sirdars, amounted to the sum of seven Lakhs of Rupees. The Rupees are, however, twenty-five per cent. less in value than the Company's Rupee, so that the Revenue would amount to five Lakhs and twenty-five thousand Rupees of the Company's currency. It must be taken into consideration, however, that all Syeds were exempted from paying taxes, as also the Oloosee troops, and a few relatives of the different Ameers, and other followers of Sultan Mahommed Khan.

During the rule of the Seiks, the trade increased, as did also the population, there being greater security for life and property, and no person whatever was exempted. Avitabile drew twelve Lakhs from the province, which may be thus divided.

Tuppah of Hashtnuggur.....	1,50,000
Eusufzai Country.....	1,10,000
Doabah Tuppah.....	1,40,000
Khalisah Do.....	90,000
Daondzai Do.....	70,000
Momund Do.....	80,000
Khulleel Do.....	50,000
Kohaut District.....	2,50,000
City of Peshawur, &c.....	2,60,000
Grand Total Rupees	12,00.000

The revenue of the last year cannot be taken account of, because of the interruption to trade caused by the disturbances in the country, the compensations granted on account of injury to fields, &c., occasioned by troops passing to and fro, and the grants to different persons for services performed for Government; under all circumstances, however, the revenue of the present year cannot fall far short of the sum realized by the Seiks.

GENERAL REMARKS.

Every village or town, with the exception of the city of Peshawur, consists of several Kundies or Streets, to each of which there is a Malik or head-man, according to the number of Kundies in the village. Each of these Kundies has its own Musjid, and its own Musafir Khanah, or house for the reception of travellers; and the people of each Street go to their own Musjids to pray, and to their own Hujrah or place connected with the Musafir Khanah, to converse after the business of the day. In the same manner, every stranger who enters a village becomes the guest of the people of that Kundie in which he first sets foot, and is hospitably entertained as long as he chooses to remain. Out of the different Maliks of Kundies, the chief of the district chooses one to be Malik of the village, and he thus becomes the Malik of Maliks. Supposing, however, that he wishes to seize on, or requires the services of, any man of the village, he cannot act on his own authority, unless the person belongs to his own Kundie, but must request the Malik of that Kundie, to which the person belongs, to arrest or bring him as the case may be. This custom prevails throughout the province, but is most strictly observed at a distance from the city, and in the Eusufzai

country. Each street of the city of Peshawur has its own Mahaladur, who has charge of it, and he is answerable to the Kotwal, or head-man of the city, for the behaviour of the people under his care.

In the Abazai valley, on the borders of Booner, there are many very old customs kept up. For instance, when a person dies, a tombstone is placed both at the head and foot of the grave, and rude figures sculptured on the head-stone indicate often the occupation held by the deceased, and, in some instances, the character also. If the grave of a pious man, the figure of a kujah or some other vessel for holding water to perform the necessary ablutions before saying prayers, is represented. If the defunct has been a horse soldier, it is indicated by a horse shoe, and a sword and matchlock across each other; and a foot soldier, by a pair of sandals.

The dress of the people of the districts consists of a scull-cap and a loose turban, generally of blue or white cloth, and sometimes of a blue and white striped Peshawur Loongie, and a shirt with loose wide sleeves, which reaches to the knee. Blue appears to be the favorite colour, on account of its being more durable than any other. They wear wide drawers, and have a Loongie fastened round the waist, or thrown loosely over the shoulders; on the feet they generally wear sandals made of grass, and sometimes shoes. The young men wear their hair in long curls: those of mature age shave all the hair off the head, but the beard is sacred.

The Afreedees wear a scull-cap without a turban, a short-waisted angrikah, or coat quilted with cotton, drawers rather tight at the ancles, and grass sandals. The dress of the women varies but little from that of the men. It consists of the wide-sleeved shirt and drawers, which are much wider in proportion than those worn by the men, and are drawn in tight at the ancle; and a white veil, which they wrap round their heads and bosoms. The hair is worn in three tresses or plaits, one on each side, and the other behind: they are very neat and particular in this respect. The better sort of people wear the boorkah, (a large veil, which reaches to the feet, and conceals the whole figure) when they go a journey, but in their own villages the women do not conceal their faces except from strangers. The dress of Afreedee women consists of a sort of gown, with the exception that the folds of the skirt, instead of being drawn in round the waist, are drawn in just under the breast: they also wear drawers similar to that of the

men, and a veil. The dress of the inhabitants of the city varies but little from that worn by the people of the districts, and the same is worn throughout Affghanistan. A great number of the inhabitants are natives of Kabul, and dress in the Persian style. The females of the higher classes dress in a gay, and at the same time becoming, manner. It consists of the tomba, wide drawers of silk, at least one yard in width, edged with gold lace or silk fringe at the bottom, and from the great width appears like a gown. This part of the dress is sometimes of printed velvet, of the same wide proportions, but drawn in tight at the ancles. The upper garment consists of a piram or shirt with wide sleeves, and reaches half down the thighs. It is made of coloured silk or white net, also edged with gold lace. The next article of dress is a veil of white muslin or net, which is sufficiently large to envelope the whole person: the dress of young maidens is entirely white. Married women wear a small red silk cap, called an "arakchen," embroidered with gold and silver thread, which just covers the back part of the head. The hair is worn parted in front, and fastened to the forehead with gum: the hair just above the ears is traced and fastened behind like a band; the whole of the hair beneath this band is plaited also, each plait being about an inch in breadth: a pair of high heeled green Morocco shoes completes the in-door attire. In the cold season a small fur jacket without sleeves is worn, and socks are sometimes used. Out of doors every female, with few exceptions, wears the boorkah, a large veil or cloak, fitting close over the head and face, and reaching to the feet. It is made of fine white cloth, and has two apertures to enable the wearer to see. Short white leggins or drawers, fastened by strings above the knee, are also an indispensible part of the out-door dress, more particularly of young females. Ornaments are worn in the ears, in one nostril, on the wrists, and on the ancles.

The dress of the Hindoo inhabitants is similar to that worn by the Mahommedans, with this difference, that the drawers worn by males and females are tight, and the women do not wear the boorkah. The Mahommedan portion of the inhabitants are generally very fair, almost as much so as the generality of Europeans. Persons may be often seen with light reddish-colored hair, blue eyes, and ruddy complexions. They appear to be a particularly clean race of people, and are very strong and hardy. They are open and straightforward in their dispositions, and entirely without the natural cunning and cringing

slavish manner of the Hindustanees, are devout in the performance of their religious duties, and generally free from vice. Taking them altogether they are a fine, handsome, independent and hospitable race of people. In some things they are not unlike the Irish.—One in particular is, that they can be led, but not driven, and a person in whom they place confidence can influence them as he pleases. As soldiers, I should say that a Regiment of Affghans with the same number of European Officers as our Native Corps have, would very nearly equal Europeans, both in appearance and in use, the greatest difficulty would be to get them to shave their beards off, and I fear they would never consent to this.

As far as I could judge of the sentiments and general impressions of the people respecting our occupation of the Country (and I have conversed with many influential parties on the subject) I should say they have every confidence in the justice of the Sirkar Kumpanee Bahadoor.

There are many Hindus in the province dispersed throughout the large towns and villages. They are of the Khutree and Parancha caste and like the whole of the race, a money getting and thrifty people.

(True Copy). A MALET,
Chief Secretary.

ART. II.—*Researches in the Vicinity of the Median wall of Xenophon, and along the old course of the River Tigris.* By FELIX JONES, COMMANDER, Indian Navy.

No. 2049 of 1851.

From A. MALET, Esquire,

Chief Secretary to the Government of Bombay.

To the Secretary to the Bombay Geographical Society.

Political Department.—Dated 17th May, 1851.

SIR,—I am directed by the Right Hon'ble the Governor in Council, to transmit to you, for presentation to the Geographical Society, in the name of Government, and for publication amongst its proceedings, copy of a Memoir drawn up by Commander Felix Jones of the Indian Navy, on the recent exploration of the River "*Tigris*," and discovery of the site of the ancient Opis, together with some sketches and a map showing the course of that river, as it anciently flowed between Qadesiyeh and Bagdad, and its position and appearance of its bed, in the autumn of 1850, when in its lowest state.

I have the honour to be, Sir,
your most obedient servant,
A. MALET, Chief Secretary.

BOMBAY CASTLE, 17th May, 1851.

In the spring of this year I had projected a Surveying tour through a portion of Babylonia and the lower Chaldea, provided a sufficiency of rain water and pasture were available on these deserted portions of Mesopotamia, which, bounded on the S. West by the Euphrates, on the N. East by the Tigris, and on the S. East by the Shat-al-Hye-a considerable branch of the latter—while, in ancient times, admirably protected to the N. West by artificial streams, contained, in these remote ages, not only a vast and highly civilized population, but boasted also of the most magnificent cities of the world, as it then existed. These, though not entirely unknown, have been visited by a few Englishmen only, and from the difficulty of the country,* as well as the wild state of the tribes, have obtained but a partial glance. At the instant of starting, however, I was disappointed by a revolt taking place among the predatory families on the Hindiyeh marshes to the west of the Euphrates, and as is usually the case—the disaffection extended to the tribes in their immediate vicinity. A letter from an Agail Chief, employed with the troops in the disturbed districts—despatched in haste—strongly recommended me to defer the visit until less disturbed times, and the departure of troops and guns from the city corroborating the intelligence, I was reluctantly compelled to abandon my design, and to leave this interesting tract for future examination, when a quieter period would enable me to fix—at more leisure, the positions of the various sites, as well as obtain specimens of the many inscribed relics lately seen by Mr. Loftus, the active and intelligent naturalist with the frontier Commission under Colonel Williams. To this gentleman and to the pencil of his associate Mr. Churchill, we are indebted for all that is positively known respecting Werka,† and other entombed cities of an ancient age and

* Destitute of water and pasture during three fourths of the year. The tribes too, in the lower portion, adjoining the Hye, are under little control from being separated into many subdivisions whose Chiefs, though nominally under the great Sheikhs of the Montafik and Zobeid, act independently of each other. The marshy nature of the tract adjoining the Hye affords also a secure retreat when aggressions, of more than an ordinary nature, awaken the Turkish authorities from their usual apathy, and in proportion to the security they possess, Arab depredations are extended or curtailed.

† Though little has been positely known with regard to Werka it has been, in name, identified some time since by Major Rawlinson as the Ur of the Chaldees, and the Orchoe of the ancient geographers. European geographer's, Dr Anville particularly—have generally fixed the locality of the Orchoeni further South than the position occupied by Werka, but the evidence of Pliny (lib. VI. cap. 26·27) and Strabo (lib. XVI. p. 739) will not agree with these conclusions. Ptolemy again places Orchoe according to Bryant in Lat. 32° 30 N. (see Mythology of the ancients, page 524 Vol. II.) In the Periplus of Dr Vincent it is given from the same authority as 32° 40 N. both being a degree nearly too much to the North of the parallel of Werka. Ptolemy's latitude would however appear to refer to the ancient Culha —represented by the mounds of Ibrahim first discovered by Major Rawlinson in 1845 (commencing on the cuneiform Inscrip 1850 note 1 page 77) Werka is the Ur of the Chaldees and perhaps the Erich of Genesis x 10 and the Ὀρέχ of the Septuagint would also seem

people in lower Mesopotamia, and in the superficial examination thus made, enough was elicited to excite a further enquiry, not only as to their character, but as to their geographical position also. This latter is, however my province, and though thwarted for the time, I hope yet to assign to these antiquated places, a correct place on our maps, at no distant period, and were excavations attempted, even on a small scale, I have little doubt but a sufficiency of material would be brought to light to repay both the antiquarian and Paleographer. In the meantime, as my arrangements for the journey are made, I turn my steps to a less disturbed tract, which has also a high claim to our regard, for with it are associated deeds of Military renown which after a lapse of twenty two centuries and a half, tend to shew how the most adverse circumstances in war may be successfully combatted by an indomitable spirit and a strict Military system.

Beyond the interest excited by a consideration of the retreat of the gallant "ten thousand Greeks" the old course of the Tigris is in itself a picture—however deplorable, of the advanced state to which this remarkable country, even in comparatively modern times, had attained, though the tide of war, from the time of the greater Cyrus to the advent of the lieutenants of Mahomed, had rolled backwards and forwards in alternate success and defeat, and whether possessed by the Mede, or the Parthian, by the Greeks—the Sassanians or the Romans, the province, we find—when free from war—in a highly flourishing condition, though perhaps not equally rich and prolific as when under the mild sway of the Assyrian Kings. It has

to be the Anderrica of Herodotus "an Assyrian village situate between the sea and Babylon" not the Anderrica of the Persian dominions mentioned in Erato CXIX. but the place of that name noticed in Clio CLXXXV. It appears to me a compound name from Ard. and Erech—the former rendered either in the Hebrew or in the Arabic, would signify "land" or "province"

ארץ Erts in the Hebrew and ارض arth in Arabic are literally the same as the "Earth" of our own tongue, the term being frequently applied also to peculiar districts or extent of country the latter, the last syllable of the compound. Αρδερικα of the Greek text of Herodotus may represent the Erech of our version of the scriptures and the Ὀρὲχ of the septuagint. Kitto in his Bib Cyclop mentions that the name Erech, is thought by some, as preserved in that of ערק Irak the present denomination of the Country around Babylonia, but the great difference in the initial letter of the terms, the one commencing with the other ع would show an inconsistency not usual in words of a Semitic origin.

Bryant in his analysis of the ancient mythology has a long dissertation on the name, the last syllable of which he assumes asidentical with the Erech of Scripture though ignorant as to the meaning of the prefix syllable of the compound, or of the precise locality of this primeval city of man, see the concluding chapter of vol. II wherein also is displayed much ingenious, learning with reference to the name in connection with the Αραχνη of the Greeks and the fine woven silks of Babylonia.

been left for the Mahomedan, however, to give this long coveted land the finishing stroke to its history. Like the victim to the "Saam" wind, it is yet lingering under the withering effects of the blast;—its weak struggles for life—evidenced in its wire—drawn canals and miserable exchequer, notwithstanding ten centuries of oppression, shewing only the strength of its original constitution. The incubus remains however in possession alike indifferent to the country's improvement or to its further decay, and while thus seated in arrogance and unconcern the parched soil will not yield its verdure though the element so essential to its culture flows continuously at its side, nor will the present population exert its energies to remedy so monstrous an evil, for, in addition to a national and inherent indolence, there is no security whatever for property. Now to my journey.

March 20th, 1850.—A disagreable south wind created such a swell on the Tigris that the floating bridge,* had to be removed to prevent

* This bridge has at the present day 37 pontoons or boats composing it. The exact number indeed, that Xenophon specifies as spanning the Tigris in his day at Sitaki. This speaks well for the general accuracy of the historian for we may presume that the same species of vessel was in use and it is certainly the most primitive, both in form and construction that one can well imagine. It bears the name of سفينة Sifineht in arabic, and is made of rough poplar logs, sheathed with very thin plank coated on the outside with bitumen. The prow and stern are as boxlike in shape as is possible to make them; rounded sufficiently only to prevent cube like angles being exposed to the stream; but the rudder is the most curious piece of Mechanism of the whole and a written description would fail to convey an idea of its numerous parts and certainly useful properties. I therefore give a sketch of it, as it is as simple, as curious, and might to the sailor in want of a rudder offer a few hints that would enable him to steer his ship when the time that would be required to make a rudder according to the methods in vogue could not be spared owing to the vicinity of land or from other serious causes. (See sketch on separate sheet.)

The following is its description and use—it may be put to in sea going—ships.

a. a. a.—The lower piece of the rudder made of a spar or plank; it should be long or short according to the depth intended to fix it under the surface. If to be just below the surface of the water only, the spar should be long and the lever or tiller—f—intended to work it, should be at least double its length one third over the stern and ⅔ within board.

b. b. Upright piece or rudder post to be made of a topmast which cut in two pieces of convenient lengths, will perhaps make both—a and b—the piece intended for a. a. a.—should be shawn also in two, longitudinally and nailed to the lower end of—b. b.—leaving projecting ends sufficient to act as guides for fixing close on the sternpost—c. c. The rudder post b. b.—should be flattened at the heel so as to fix the two pieces—a. a. a.—which, when on, must be loaded inside with stones, pigs of ballast &c. to give it weight and keep it firm in a sea way.

c. c.—The stern post; the native boat has holes to receive the lashings—1. 1. 1.—corresponding to the holes in—b. b.—for a ship however, this would not answer independant of the time required to make them; for it would render the whole weak which at sea would require to be peculiarly strong lashings round all fastened to b. b.—must be passed therefore to rag eye or ring bolts driven into the sides of the stern past which could be done easily while the rudder is being made—and until the lashings are passed, the rudder must be kept as close to the sternpost as possible, by means of several tackles fast to stout rudder pendants—g. g. g—that should be clove-hitched while inboard round—b. b.—leaving ends on either side to reach the quarter ports for clapping the tackles on to. These in themselves, with the weight of the ballasted rudder, the projecting ends of a. a. a.—clamping the stern post, and a stout upper lashing which can be put on, on deck, will maintain the rudder in its place with ease; the pendants being kept fast even after the lashings are passed for greater security. The lashings should be cross seized and in this state will act as a hinge or combined pintle and gudgeon for the rudder to turn upon.

d. d. d. d.—Diagonal spars to support the tail of the rudder. These are fixed to the head of the rudder post b. b. and to the tail of the pieces a. a. a. on either side. The main piece of

injury to the boats. The horses, mules, and baggage, had therefore, to pass the river in the circular basket scalled the Kufat* to the western bank—a work of some difficulty at such times. The party with myself and Mr. John Taylor, my usual companion on these tours, consisted of a dozen people (a larger number than I usually take, but necessary for the projected journey to Werka) headed by Ahmed-al-kode and Agail Sheikh and two Bedoins of the Shammar and Dhiffyr tribes. The rest were armed Kawasses,† a tent pitcher and servant. Besides the usual

this might be a jib-boom or similar rough spar—whose heel passing between the pieces a. a. a. might be lashed at the head of b. b. and this perhaps would answer the purpose of the four pieces used in the native boat.

e. e.—Similar spars passing from the heel of b, b. to either side of the tiller f. and lashed to the spar or spars.—d. d. d. d. where they cross each other.

f.—The lever or tiller working on the head of b. b. and the upper ends of the spars e. e. These may be termed the fulcrums, and it will be readily seen from length of the lever or tiller f.—how easy such a temporary rudder could be worked by the manner of connecting f. with the heel of b. b. through e. e.; and f. fixed at the head of the rudder post b. b. through d. d. d. d —with the tail of a. a. a.

g. g. g.—The rudder pendants clove-hitched round post. b. b. where convenient, their ends leading to the quarter ports on either side the vessel.

The sketch represents the rough plan used in the native Sifineht. It will be observed that the rudder is intended for vessels of shallow draft of water by its breadth a. a. a. and will act equally well for ships of any burthen, if the length of a. a. a. be increased in proportion to the decreased height of the rudder post which, in temporary rudders, is a desideratum inasmuch as the great difficulty lies in securing below the water mark. With this plan the rudder need not be two feet under water and the lashings entirely above. To the Naval officer, experience will readily suggest any improvement; as for instance, instead of lashings, stout strops with salvage tails might be secured, while inboard, round the rudder post, at convenient distances, whose ends, when the rudder was fairly slung, might pass through the eye or ring bolts used on the side of stern post c. c. and then set taught from the poop or cabin windows by small jiggers or by the most convenient method suggested at the time. In a well ordered ship of war, bearing several artificers, six or eight hours should suffice to put this temporary rudder in action and the advantages attending such dispatch might be incalculable. I make no apology therefore, for introducing so antiquated a machine to the modern reader, though a method of fitting temporary rudders may be deemed foreign to a geographical narration; indeed the traveller should notice every thing within reach of his eye and at the same time not be ashamed of copying the simple contrivances of other nations, for we may derive a hint from many an uncouth machine that, improved upon, may benefit ourselves. The vessel altogether is, indeed a rare specimen of marine architecture and probably has not been improved on, since the flood. Noah in this country, has had neither a Seppings nor a Symonds to succeed him in the art of ship building and the ark therefore, which is known by the same name of سفينة Sifineht in Arabic distinguishable only as the سفينة النوح Sifineht-al No'h (ship of Noah) may, indeed, have been the prototype of the curious vessel in use at Baghdad in the present day. It is certainly very ancient both in form and appearance.

* This peculiar species of boat was in existence in Herodotus's time, he described it however as covered with skins; (Herodotus in Clio art 194) it is now coated with bitumen only, and might have been so in his day for without a minute examination the difference is not perceptible. Further on however (same art,) he evidently confounds the Sifineht spoken of in the previous note with the raft and the Kufa as respects the raft, the same method of disposing of the timber &c. is in vogue precisely in the same way, in the present day; and it is still a fact that "the smaller of them has generally one ass on board." The circular boat or Kufa the "Asphaltic Coracle" of a modern writer—is by no means uncommon—that is, as regards its shape—on the English rivers and at Porto Novo, a sea port on the Coromandel coast below Madras, they are much used in floating the iron ores of the upper Country for smelting at the foundry erected there.

† The Kawas, قواس is a compound biped of great use in this country though generally as ignorant a creature as can be imagined. A sort of soldier servant, courier and lictor comprised in one and the same person, and indispensible to all that have much communication with the natives, particularly with the Arabs.

animals, I had purchased for the Werka journey, two dromedaries and a quantity of skins, so that I could move about independent of the known watering places. Twenty minutes were occupied in threading the narrow and filthy streets of that portion of the city denominated the suburbs of Baghdad, on the west of the Tigris, now a mass of ruins, the exterior defences or wall having been prostrated by the flood of 1839, and its material above the foundations, as appears to be the general custom, removed—either for repairs, or for the erection of other buildings—unnoticed by the authorities. The day was of that sultry and oppressive character usually attendant on Southerly* winds in Syria and Mesopotamia. Clouds of dust hung as it were suspended in the surrounding atmo sphere, which was rendered stagnant by its density and caused a feeling to be experienced akin to suffocation. This we not only felt ourselves, but it was evident as we passed amid the throng, for on the heaps of rubbish, accumulated at the corners of all Eastern streets, were congregated groups of two or three individuals awaiting to undergo in turn, the operation of phlebotomy, commonly resorted to, at these times, in this country. The barbers indeed, must have had a profitable day in their several Mohullas,† if we may judge from the streams of blood that trickled down these heaps, and from the smiles of satisfaction displayed upon their countenances as—lancet in hand they left off to admire our cortége as we passed along. These close and torrid days are frequent in this month and give one a foretaste of the approaching heats of summer. They forbode rain, which follows generally in a day or two, and then a succession of Northerly winds usher in, an elastic and high renovating spring temperature.‡ It would appear, however, that these south winds and sudden heats,§ form a part of the great system, for they are essential to the development of plants, hastening their blossoms, as well as assisting in the process of incub ation and thus serving to vivify insect life, while, at the

* The feeling attendant on, previous to, the coming of a south wind is not a new one, see Luke XII. 55. and Isiaiah XXI. 1

† Mohullah, signifies any distinct quarter of the town. The barbers in Baghdad still exercise the vocations of surgeon and dentist in addition to their more regular occupations, and are equally loquacious with their western brethern.

‡ The North wind driveth away rain" Proverbs XXV. 2. 3.

§ See note † page 6.

same time, the species that have lain dormant during the winter, are reanimated. Man's period of annoyance has then arrived, and it ceases not until the end of October. In the short space of a few days he is surrounded by every variety of insect, of which the common and the stinging fly, are the most numerous assailants, in connection with myriads of wasps and drones by day; while at night, when rest is so much needed, the mosquito and minute but doubly abominable sand fly, are ceaseless in their endeavours to prevent it. Frogs and toads too, when the rivers are unusually high, are very troublesome and hop, unrestrained, over every part of the summer apartments,* or "Sardabs" as they are here styled.

Leaving the broken walls of the town for the open country it occupied fifty five Minutes along a tolerable road, in reaching Kathemein,† whose gilded domes and handsome minarets form objects of great beauty as they stand out in relief against the sky beyond, and high above and in glittering contrast with the sombre date groves around them.—A nearer approach however displays the real character of the religion and its votaries. The really handsome Mausoleum is encircled with the bare and crumbling walls of wretchedly built houses, mostly of mud and rotten bricks—that form the town which is inhabited by Arabs and

* The words of the Psalmist apply equally well to the lower lands of Mesopotamia, as to the Delta of Egypt, in these respects, Psalm cv. v. 30. 31. The words are literally exemplified in the present day, and though I have not enumerated the "wee" multipede of Burns' lay and of the Psalmist's description in verse 31, still they too, are not wanting, but occupy an *exalted* position in every native house, see also Exodus VIII. "Sardab" سرداب is a compound Persian term litterally signifying "cold water" and applied to apartments under ground in which ice is kept in Persia hence the application of the term to the inhabited cellars in use at Baghdad and Mosul.

† The Imám Músa al Kathem the seventh Imám revered by the Shiahs and his grandson Mahomed Taki the son of Ali Kidha the 8th Imám lee entombed here. The Imám Músa was the great great grandson of the ill fated Husseyn, the second son of 'Ali, the son-in-law of the Prophet Mahomed. He was brought to Baghdad from Medineh the place of his residence—by the Khalif Hárún-al-Rashid fearing that his presence in Arabia only fomented the existing troubles and as as the Khalif's suspicion increased, he caused him after some time, to be imprisoned by his Vizier Ben Khaled on this spot. He is said to have been generous and patient in the endurance of affliction, and was much revered as the faithful guardian of the history and traditions of his unfortunate house. His death took place in A. H. 153. His grandson Mahomed Taki the sharer of his tomb was so much esteemed by the Khalif Mámún that he gave him his daughter in marriage and he afterwards accompanied, his father in law to Baghdad. The relations of the Khalif however were not pleased at the step and it is supposed that he became another victim to the existing hatred against his race, by being poisoned at Baghdad in the 25th year of his age. He was buried with the pomp due to his position in the Khalif's family by the side of his grand father in the tomb of the Koreish as D'Herbilot terms the Sepulchre at Kathemein—Vide Bibliotho. Orienti. tome II. "Kathem" in Arabic signifies "generous" and was the title of the Imám Músa. Kathemein the name of the Modern town and tomb is the dual of the term in reference to father and grandson; the Arabs, however, usually use the singular "Al Kathem" only, when naming it. The Domes were last gilt I am told, by the celebrated Nadir Shah.

Persians, with a sprinkling of Indians of the Shiah sect that have been exiled from their country for political offences, or have strayed here from a feeling of sanctity combined with a wish to prey upon their fellow pligrims.—The tomb is numerously visited from all parts of the Mahomedan world where 'Ali and his race are the peculiar objects of veneration pomp and beggary.—Silk and rags, are seen jostling each other in the Court of the Mosque, and a halo-like fanaticism dangerous alike to the christian or the jew, renders access to it impossible by these sects, sufficient however is seen of the building to cause regret that but few edifices of the like architectural beauty and ornament are met with in a country where such a style is adopted. The Minarets and square encompassing the dead are elaborately enamelled in a rich Mosaic work, and the walls are also adorned with legends from the Koran, and the sayings of holy men, executed in elegant Arabic characters, after the manner of a tesselated pavement. Apart from the decaying hovels around, the sepulchre itself would form a magnificent picture, and even now at the distance of a mile—its double dome and lofty minarets, entirely covered with beaten gold, cannot fail to excite the admiration of a lover of the picturesque. The eve is that of Nú-Roz* on the new year of the old Persian calendar—a day of rejoicing as well as of prayer, and the scene before us as we pass along the road, has become more animated than usual. The sun is just casting its last rays on the prospect; the gilded minarets alone, from their great height, are just tipped with its beams, and resemble as many stars in the distance guiding the multitude to the shrines. We pass individuals of every feature and race. The wanderer from far Thibet and Cashmere, the Affghan and the Persian—the Mogul and the native Arab, both horse and foot are proceeding to take part in the festivities of the ensuing day. Others have spread their carpets, or their cloaks by the road side, and kneeling in the attitude of prayer, are performing their devotions with an energy, that might be considered sincere did we not know the character of the people. Turned towards the Keblah of their faith, their countenances exhibit every variety of feature and, perhaps in no place of the same extent, can be remarked so many forms of the "human face

* نوروز Nu-Roz (Persian) the day of the vernal equinox and the commencement of the old Persian year. It signifies literally "new day" and is a day of great rejoicing with the Persians.

divine." Nor is the antithesis wanting, for in similar numbers of the species, wherever congregated, there would not be displayed, perhaps, so many of the bad propensities of our race; on a sudden excitement all the evil passions are called into existence, of which ungovernable rage, inordinate desire, and duplicity, are the most prominent. The expressive features of the Arab, however, joined to his picturesque garb, the keenness of his eye, and independence of manner, with his weapons on the carpet by his side, evince a superiority in race, and though humbling himself in prostrations and prayer,* the same inherent fierceness can be distinguished in his glance, that spread his doctrines among so many nations; and doubtless at this moment he is, as personally ready to draw the weapon in defence of his creed, as were his ancestors in its promulgation.

Leaving the Kathemein gardens which are of some extent and beauty, we enter suddenly upon a district termed Tají, now a complete desert in all respects, excepting only a strip of cultivation extending in no case above 300 yards from the river; indeed, during great inundations, or even in moderate rises of the river, the Marshes of Akr-Kúf—formed by the overflowing of the Euphrates 50 miles distant—connect themselves with the Tigris and envelope Kathemein and its gardens, as islands in a wide sea of water—Baghdad, and the gardens in its neighbourhood though better cared for, have, for the last two years, suffered a similar fate, owing to the apathy of the authorities in not repairing the 'bunds' in time—and the town is not only isolated—crops destroyed—houses injured, fruit trees decayed, but the receding rivers, leave behind them on the surface of the plains, vast Marshes, which create not a thought in the Government to drain. The consequence is—as we have experienced the last two years—these lakes, as they become stagnant, are converted into fetid and unwholesome swamps. By the middle of June a rank reed has grown within them to a height of several feet, at which time a torrid sun, until the end of October, is slowly evaporating the moisture and leaving slime and vegetation festering under its rays. An atmosphere thus poisoned, has to be inhaled by the population at a time when the tremendous heats are scarcely bearable by man; and fevers

* The Koran forbids the wearing of weapons or even iron of any sort on the person, during the performance of prayers at any time. How different this from our Church parades where side arms are enjoyod as part of the ceremony in the Military Officer and the soldier.

exhibiting in many cases a fatal type, assail, with few exceptions, every man, woman and child in the Pashalik, from Samara to the Persian Gulf. Basreh and the lower country within the influence of the humid air of the sea, is at these times peculiarly fatal—but to the North—owing to a higher soil and a drier atmosphere accelerating evaporation—the period of its malignity is short and decreases monthly in its ravages. Relapses occur as regular as the spring tides on a sea coast with the full and change of the Moon in almost all cases.

The effects however, may be imagined on a population composed principally of poor, without medicine of any sort, and to this chiefly must be ascribed in my opinion, the annual decrease of the Myriads that formerly peopled the fertile plains, for these inundations have occurred more or less from time immemorial. History, indeed, furnishes us with the ravages made by these floods,* even in periods when a well regulated Government managed to keep the substantial "bunds" necessary to the country in constant repair;—can it then surprise us, if the imbecile measures that have been grudgingly adopted since the modern Persian and the Osmanli idler got possession of the soil, have failed in effect, or have tended still further to deteriorate the jewel that fell to their share, during periods of universal anarchy and confusion? The wonder, indeed, is that it still remains intact however tottering—amid the visitations of Pashas and disease. For the former their is no remedy, I believe, as long as the Turk and the constitution of Turkey remain the same; the "leopard cannot change his spots" nor the Turk divest himself of his character alike remarkable for avarice and pride. The latter would however soon vanish under a satrap of a well ordered empire, for the climate, when uncontaminated with Malaria, is naturally perhaps the finest in the world, and in this I speak from a long experience. The fevers, indeed, as they are, readily yield to febrile remedies and the precaution of taking quinine, a couple of days previous to the coming on of the lunar changes, in general prevents a relapse. Even

* All historians dwell more or less on the ravages made by the neglect of the dikes, and on the Marshes existing even in the vicinity of the capitals from a very early time. In some cases these offered material obstacles to the invader from the difficulty of crossing them with troops and heavy engines of war. In others, their pestilent nature lent it's aid in thinning the ranks of the enemy, while at the same time, it created sickness though in a less degree to the assailed for they must be supposed, to have been partially inured to its effects. See Yakút in Majm—al—Buldán on the Kátúls, Nahtwan and other canals. Zosimus corps Historic—Book III in his description of Julian's March against Ctesiphon—and Masúdi—Sprenger's translation Vol. I page 254; 255, in particular.

at this time, though a year has elapsed since the last flood, the Marshes around Akr-Kûf are within two miles of the Tigris never having dried up as they usually do, during the whole of this period.

By dusk we had reached the bank of the Tigris where we joined our dromedaries and the cattle that had gone on ahead. The Steamer was also here for the purpose of displaying flags from her mast head, which can be seen at a considerable distance inland, thus enabling me to fix my position with great accuracy from day to day; she moving to allotted stations on the river, determined at a former period, while the party makes similar marches by land. Spreading our carpets on the bank of the river in the open air, our recollections of the events of the day grew gradually more and more confused, until they were finally lost sight of in a deep sleep, such only as the wanderer knows. It did not last long however, for some heavy clouds succeeding to the southerly wind of the day, foreboded rain before evening set in, and heavy drops fell, by no means agreeable to those who have but only one suit of clothes to their backs. It cleared up in a few hours to our delight, leaving us only a little damp, and a brilliant sky only known in these latitudes, became our canopy instead of the thick coverlid that threatened a deluge before morning.

The paddles of the steamer set in motion at day break, summoned us from our carpets to the saddle. The whole party was soon mounted, for a terrier-like shake, to fix one well in his boots, which are usually slept in on these expeditions completed the toilet, and a 28 minutes advance to the westward over a bare country—evidently often submerged—brought us to the high embankments of an ancient canal* that is now termed Serakha from a ruin occupying it's bed, which I shall afterwards speak of. One mile N. N. W. of this spot a deep hollow named Aḥweyneh† receives in the high season of the river, when the country is inundated, a body of water now forming a small lake, which I am told remains unabsorbed during the whole of the summer, we can trace the canal extending farther to the S. S. E. in the

* See appendix A. The observations, bearings &c. taken on this tour will be found in the Appendix, so as not to interrupt the course of the narrative.

† Appendix B!

direction of Zobeide's* tomb, but it is said to be lost before it attains to that distance, and the numerous offshoots, still well marked about this spot—on either side of the trunk stream, shew that in the neighbourhood it had reached to it's limit of irrigation, a small tomb stands on it's mounds about one mile S. E. of our position, and immediately to the west of the Kathemein groves. We now rode along the bed of the old conduit, which winds more than is usual with these ancient works. It's breadth is about 15 to 20 yards and the quantity of brickwork seen on either side shews that it's banks were well peopled by a fixed community—many irrigants were fed from its waters—indeed, so numerous are these they forcibly reminded me of the canals described by Xenophon, which the army crossed after passing through the Median wall.† In ten minutes we had reached a similar lake to Ahweyneh but of somewhat greater extent. The circular form and perpendicular walls of these extraordinary hollows, mark them as the work of man—probably in a remote age—but for what purpose unless as artifical adornments to palaces that may have been erected on the sites it is dificult to determine. Both Ahweyneh and this lake, which is named Serakha abound in fish, tortoise and the pecular fan-tailed turtle of the Tigris, and seem to be of considerable depth, their diameter may be 150 to 200 yards; a ruin of a very massive character, and certainly of great age is seen on the East border of the Serakha lake, the old canal that we have ridden along having been apparently led over it, for digging through its bed exposes the structures beneath, which is built of large kiln burned bricks embedded in bitumen, and indeed is the only ruin in this country that I have seen which answers in it's construction and material,‡ to the detailed description given by Xenophon of the Median wall.

I am not however going to discuss at present the often attempted question of identity of the Το Μηδίας Καλουμενον Τεῖχος of the Anabasis, but merely to state the existence of things as I find them, contenting

* The last resting place of the celebrated lady of the name in the Arabian nights.

† Xenophon Anabasis Book II—From thence (the wall of Media) they made in two days March eight parasangs and passed two canals. One upon a bridge, the other upon seven pontoons. These canals were derived from the Tigris, from them ditches were cut that ran into the country, the first broad, then narrower, which at last ended in small water courses such as are used in Greece to water panic. Thence they come to the River Tigris &c. &c. at Sitaki.

‡ Anabasis Spelman's translation—Book II page 33.

myself, however, with advocating the venerable character of this ruin, not from its appearance alone, but from the fact of the waters of the canal itself when in existence having flowed over the pile; and if ought more is wanting to give it a claim to a high antiquity, we have buried in the bed of the canal above it, in a straight line with its course, a nicely arranged and continuous tier of sepulchral urns, amounting to thirty-four in number. I tried in vain to extract a perfect one, but they crumbled to dust on exposure to the air. In shape they differ from most of the urns disinterred on this soil, and though lined on the inside with a thin coating of bitumen, their contents, except in being more damp, were not distinguishable from the earth of the surrounding soil. The ruin and canal, indeed, derive their names from the peculiar form of this urn, though I was at first inclined to view the term *Serakha* * as an ancient one, whose meaning was unknown in the country at the present time. The bricks seen here are of the size and shape of the Babylonian period, though I could not discern any stamped characters similar to those found in the most remarkable Babylonian structures; indeed this peculiarity may have been in use only on the material of the more sacred edifices, and as at the Kasr, on the recognised site of Babylon, the ordinary buildings, whether palaces or of other public character, may have been constructed of bricks of the prescribed size without bearing the legendary tablet; I have indeed heard from others that the cuneiform stamp had been seen on the bricks brought from hence. The number of shafts sunk in the soil attest, however, that a vast mine of material exists here and in the immediate vicinity, did not the caravans of asses passing to and fro between Baghdad and Serákha, laden with bricks of a large size, show the extent of the city that once occupied the country contiguous to the Tigris and the canal. When we reflect, too, that this has been the store from whence these supplies have been derived, perhaps for some centuries past, the mind will not be at a loss to comprehend the magnitude of the cities named by sacred and profane writers as existing on the soil; a surprise rather will be expressed that,—notwithstanding the devastation of war, the trade in material, the ravages occasioned by the destruction of canals, and the annual

* Serakha سرخا signifies an elongated earthen vessel.

overflowing of the rivers,—so much is still left for the modern travellers to contemplate, and if possible to connect the present with the past.* The finding of urns entombed in the bed of the canal attaches more than ordinary interest to the spot, for their number and regularity of interment would mark it perhaps as the scene of a conflict, while the canal was in the course of formation. †

Still following the course of the Serákha aqueduct, a nine minutes' smart walk brought us to other extensive ruins now termed *Suk* سوق a bazaar or market-place. ‡ They occupy both banks of the canal, which here makes a short bend, and was also led off, when in operation, into minor branches, one on either side, to the East and to the South-west. These ruins, as far as can be judged from a surface view, are comparatively modern; from the excavations going on, however, the foundations of houses show that they belonged to substantial buildings at one time, and perhaps were a continuation of the ancient city we have spoken of before—for, between it and Serákha, the smaller irrigants are abundant, while to the North of the two larger ducts described above, they are only occasionally seen. Here we quitted the course of the Seráka, which now takes the name of Al-Suk, and can be distinguished as coming in a tolerable straight line from the NNW. as far as the eye can reach.

* In the indulgence of the license generally accorded to travellers, in the absence of more positive grounds whereon to establish the identity of places, I take the liberty of suspending "a castle in the air" over this antiquated spot, by venturing to pronounce the locality as the position, in my opinion, of the Silaki of Xenophon. This is not advanced from a desire to indulge in any theory of my own, but from a consideration of the itinerary of the "Ten Thousand" in the Anabasis from the extent and position of the ruins, and more than all on the half expressed ideas of Major Rawlinson, who sometime back, on digging in the suburbs bordering the river to the West of the modern Baghdad, in a very low season, discovered, below the usual low-water marks, the foundations of ancient edifices, whose bricks were inscribed with the cuneiform character, (see note, page 302, *Beng. Asiat. Jour.* April 1847.) From the modern Baghdad, on the West of the Tigris, to Serakha and the ruins under consideration, may have been the extent of the city and its environs. Xenophon, in the Anabasis, Book II., distinctly says, (without reference to his usual distance of the parasangs, and accordingly leading to the supposition that the positions were contiguous), that, after passing the canals, "they came to the River Tigris, near which stood a large and populous city called Silaki, at the distance of fifteen stadia (a little less than two miles,) from the river." A glance at the map which accompanies this paper will show the distance of the bend of the Tigris with reference to Serakha and its ruins, agreeing in all respects with that of the military historian. The nature of the country, if we may judge from the canal, the remains still *in situ* between it and Baghdad, the present position of a pontoon bridge of a similar number of boats to that mentioned by Xenophon, which perhaps has remained the chosen spot of crossing, from the fact that Orientals are averse to any change in the order of things when once established,—all tend sufficiently well, I think, to indicate the position of Silake, and moreover, the distance of the bridge from Opis, if the difficulties of a canal country, and the harassing nature of the marches undertaken in the face of an active enemy, be reckoned, will further accord in corroborating it, even if no indulgence on the score of errors be allowed to the early geographer, who, we are led to believe, wrote most of the Anabasis from memory alone, subsequent to the return of the expedition to Greece.

† For the bearings observed at Serakha, see Appendix C.

‡ See Appendix D.

Keeping now a course of NW. by N., to the left of the line of canal, we crossed a country without a blade of vegetation beyond occasional patches of a reed-like scrub indigenous to marshy tracts. In fact, the extensive marshes now in the neighbourhood of Akr-Kuf have but slowly receded from this position since the inundation of last year. An hour, less three minutes, was occupied in reaching a place where a deep hollow shows that excavations have likewise been carried on to some extent for the sake of building materials for the modern Baghdad. The place is known now as Hammamat, "the baths,"* and from the depth of the foundation, there would appear to have been originally some large building erected on the spot. Beyond some well-baked bricks, and the destruction of a thicker cement of a very fine lime, it differs not in character from the other ruins. It derived its water from the Súk or Seráka Canal, as did also, I think, a high mound of ruins known as Tel Abdar, † about a mile to the SW. of it, (which we did not visit, for we passed two large ducts emanating from the Suk on our way here.)

Leaving Hammamat we crossed to the NE., over a country of the same uninteresting character. In thirty-one minutes we again stood on the Serákha, or rather the Suk as it is now called, among heaps of ruins denoting the situation of another large town in the days of the country's prosperity. The surface of these mounds, perhaps from being more elevated at this part, exhibits broken pottery in great abundance, as well as pieces of glass and other scoriæ. We continued onwards after a few minutes' halt, and in thirty-eight minutes from the upper Suk,‡ reached a large mound, on the West bank of the Tigris, that bears an appearance of a greater antiquity, and perhaps, were it excavated, would, like Tel Mahomed and other mounds of similar aspect, yield some relics of a Babylonian age and character. It is known as Tel Goosh at the

* Hammamat,—Arabic plural of *hammam* حمام "a bath." See Appendix E for determining its position and that of Tel Abdar.

† I am inclined to view this name as an old one in the country; Abdir or Abádir was an appellation of the deity in olden times, when "serpent worship" formed the religious creed of early mankind. Bryant, in his Analysis of the Ancient Mythology, makes Abdir the same personage as Opis under a different denomination. See vol. I. page 476. The Arabs at present attach no meaning to the term, though if it be the superlative of بدر *bedr*, it will signify either "most plentiful" or "completest."

‡ The upper Súk, see Appendix G.

present day:* its circumference may be about 300 yards: at this spot the districts bordering the river, named Taji and Mazurfeh, extending from Kathemein, terminate,—the former at Sheriý-'at-al-Beytha, a well-known easy descent to the river, where cattle are taken to drink, and in the neighbourhood of which the Bedoin plundering parties generally hover in search of prey. The name is from *sheriý'a* شريعة "place of drinking for cattle," and *beytha* بيثا "pure."

These districts are void of date trees, which do not extend on this side beyond the village of the Imams; they are cultivated by families of the Jebour, the Batt, and the Dellim, who have migrated from other parts; and a small tribe of Albu Sakr lead a nomade life in the desert West of it, around a ruin termed Stehh, which I have not yet seen; but they are entirely pastoral, and of the Sunni sect of Mahomedans.

By the time we had reached Tel Goosh every object had become obscured by clouds of fine sand that were suspended in the surrounding atmosphere, giving out a lurid red haze quite painful to the eyes, as it was urged along by the breeze that was blowing from the South. The heat and oppression was worse if anything than yesterday, and we were glad therefore to shelter ourselves under a small bichobá,† carried for the protection of the instruments in case of rain. This was pitched in a fine field of barley under the lee of the mound, and shelter had scarcely been obtained when the weather became doubly thick, shutting out from view even the date groves on the opposite side of the river, rendering further progress impossible. To add to our distress, the poorness of the place, though within ten miles of the capital, could not supply us with a lamb or a draught of sour milk to season our meal, which otherwise was amply enough furnished from the saddle-bags: we could not, however, dispel the gloom around, and therefore awaited patiently, within our circumscribed horizon of ten yards, until the curtain

* Tel Goosh, Appendix H; I really cannot say what the etymology of this term Goosh may be; Tel تل is the common Arabic expression for "an eminence" or "mound," and Goosh, as it is pronounced, but spelt كوش if an Arabic word, has no meaning that I can discover. When the Tigris flowed in its ancient bed, Tel Goosh, it seems to me, stood upon the East bank; the country is so cut up by the marsh that it is now almost impossible to speak with any certainty.

† This word has become anglicised of late years. It is a compound Persian word signifying a tent which has no pole. From بي *be* without, and چوبا *choba*, "pole," or "stake."

should be raised by a downpour from the NW. which—the clouds congregating in that quarter towards sunset—threatened before the morning. These appearances were not belied, and by midnight we had a succession of squalls from all parts of the compass, attended by thunder, vivid lightning, and rain. To sleep was out of the question amid the chaos of noises. Between the thunder claps the snorting of the frightened horses that had broke from their fastenings was commingled with the heavy sound of their hoofs and the anathemas of the grooms, launched forth in the choicest patois the Arabic affords, as they drove them towards the tent,—which these worthies regarded only as a net, from its many lines, to catch stray cattle in: added to these, the violent gusts of wind, veering on all sides, brought the rain in upon us, and kept us in an unenviable state amid the impenetrable darkness of a night like Erebus. Every instant we expected the tent would be swept from its fastenings, loosened or torn up as they were by the floundering of the horses amongst them; but our "Nusseeb," * as the Arabs say, was in the ascendant, for with the dawn the veil was removed, and all traces of the previous clamour had subsided, as the increasing NW. breeze drove the heavy vapours to the South. The drowsy grooms, wrapped in their wet 'Aabas,† shivering with the sudden cold, were now assembled in groups around half-lighted and sullen fires, awaiting in anxiety the rising of the sun, whose appearance was welcomed by every one; the picketed horses even neighing aloud, expressed a delight which we ourselves felt at the change since yesterday. By half-past ten the fog that lingered on the ground was dispelled, and having taken the observations for the position of Tel Goosh,‡ we resumed our march to the Northward.

Entering upon the districts of Suadiyeh, a cultivated strip only, adjoining the Tigris North of that of Taji, it occupied two hours—over a desert covered only with a parched-up scrub, here and there dotted with the broken lines of the Suk Canal—in reaching the deserted

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* Nusseeb نصيب "fortune," or "destiny"—the Arab equivalent of the Persian bakht. بخت

† 'Aabás عبا a mantle, of either goat's or camel's hair, universally worn,—the latter are of superior texture.

‡ See Appendix H.

building, known by either name of Khan Tarmiyeh * or Suadiyeh, being erected on the border of both districts. Tarmiyeh, immediately adjoining that of Suadíyeh to the North, like all other works of the kind, is of a square form, but larger than most Kháns in this country, constructed entirely of kiln-baked bricks, and boasting of a fine entrance and other ornamental work: it must have cost a considerable sum to erect. It has a double range of vaulted apartments, one each side, and a capacious area, both capable of holding I should say a thousand men, with their merchandize and cattle. The high road to Mosul, as late as fifty years back, led along the West bank of the Tigris through the Dijeit districts, past Tekrit and Khan Kharneineh, a similar building just to the South of the Jebel Mak'hul,—thus shortening the time occupied at present, on the road East of the Tigris, by three days. Since the vigorous days of Daud Pasha the line has been abandoned; the encroachments of the Arabs, and the power the Shammar Bedoins had attained to under the celebrated Sufuk, rendering it impassable, even as a pilgrim route to Samara,—unless, indeed, a large body of armed men were retained, at the private expense of the parties, as an escort on the journey. A dried-up well, facing the doorway, formerly afforded a supply of water sufficient for the purposes of the establishment; so long as it yielded moisture the Bedoin hordes resorted to the spot after the commercial path had been abandoned, and by way of pastime amused themselves, while on the look-out for prey, in demolishing the interior. One pulpit, and the platform whereon the inmates congregated for prayer within the building, is still perfect, but the other has been wilfully thrown down, a few years back it is said, by a lawless band of Shammar. The ruins of an old Khán are seen about a mile South of the present structure, and a deep indentation in the soil shows that the old course of the Tigris either led this way, or later inundations of the Tarmiyeh Lake have found a vent in this direction on their way to join the marshes around Akr-Kuf. The

* Appendix I "Khán" or "caravanserai" buildings, at fixed halting-places, on the great plains leading from city to city; their erection is recommended in the Korán as a pious work, and the great roads of commerce in former ages were well furnished with them. The irruption of the Arabs, and the general insecurity consequent on the weakness of the Government, have served to ruin many of these useful edifices; nor for the same reason are charitable works of this nature at the present time persevered in. Herodotus mentions them in his day under the name καταλευσεις and they doubtless existed from the earliest periods of communication between countries in the East. See Heeren's *Asiat. Hist.*, vol. I. page 31, and note 9, where he has an excellent paragraph on the construction and use of these places of accommodation.

Arabs located in the vicinity are the Suadiyeh and Meshahedeh, who cultivate the West bank of the Tigris between Tel Goosh and Jedideh: they are Sunnís; but a Shiah tribe named Khasrej wander in the vicinity of the Khán and the Tarmiyeh, whose occupations are entirely pastoral.

Despatching a Kawas * across the country to Jedideh, with instructions to move the vessel to the next appointed station of Sindiyeh, we awaited his return at the Khàn, as well as to obtain shelter in the heat of the day, which, in this month, begins to be considerable. By 2 P. M., however, we had mounted, and keeping a course of 34° 3″ traversed a bare plain without anything to relieve the monotony of the journey, excepting occasionally crossing branch lines, emanating originally from some large canal, which, I am told, passes a little to the East of the line of our route. The glare from the arid tract was very painful. An hour and a half's ride from the Khán brought us upon the large canal alluded to, and called by the Arabs *Nathriyát.* † It comes from a direction of NNW., and is considerably elevated above the surrounding country, with high steep banks on either side of its bed, from whence, indeed, it derives its modern name of Nathriyát. Like other conduits used for conducting water from a hard soil on a high level to depressed alluvial districts, the course here is very sinuous, to break the force of the stream, and to give an easy descent to the element into the plain,—in the same way as horses or men take the diagonal slopes in the descent of a hill instead of the steeper and straight path. This spot is on the verge of the tertiary and alluvia; the surface soil here changing, as you proceed North, from argillaceous earth to pebbles, which latter increase in size as you progress upwards. As yet, however, they are here mere washings, as at Akr-Kúf; and a line drawn directly South, from Khán Dholoiyeh to the East of Tigris—through Nathriyát, Akr-Kuf, onwards to Khán-Iskenderiyeh, on the road to Hillah—will define the exact geological separation of these surface soils in this part of Mesopotamia. From Dholoiyeh Northwards, the course of the ancient Batt Canal may be

* Kawass, see note ‡ to page 4.

† Nathriyat is the plural of *nathr* نظر "observation," and, attached by the modern Arabs to the elevated mounds on this canal, implies "look-out places," from its being a favorite resort of the predatory Arabs, who, stationing one of their party on the summit, see to an immense distance around, remaining concealed themselves in the bed of the canal, until it suits them to issue forth, and sweep off flocks of caravans that may have strayed within reach of their vision.

considered the division until approximating the Hamrin Hills, when the line curves abruptly to the ESE., in a direction with these well-known ridges, at a distance from them varying from four to ten miles, perhaps, in extent. But to resume,—immediately to the East of Nathriyat—between the canal and the Tarmiyeh Lake, now well supplied with water—formerly stood a large city known only as Abu Sakhr * by the people around. It was upwards of a mile in diameter, and is now quite levelled, excepting only a single mound, with the soil it stood upon; the surface of which, however, exposes its extent in being strewn with bricks and a very fine pottery. Besides these we obtained coins much corroded, and crumbling to pieces on the touch, beads, and glass of a fine manufacture. The devices on the pottery were fanciful enough to induce my friend, John Taylor, copying them, † and some rude figures of animals in terra cotta would perhaps assign to the ruins a pre-Islam era, though doubtless existing as a town since the Mahomedan occupation of the country. The Tarmiyeh waters are collected in a hollow of the country immediately East of this, and derive their supply from Tigris by a canal cut from the West bank of the river, opposite to the village of Mansúríyeh—the name of a large date-grove and gardens, situate on the East bank of Tigris, but irrigated by the Khalís Canal. The lake is exceedingly pretty at present, surrounded as it is by a margin of short green verdure, dotted with the tents and flocks of some families of Khasrej, who politely sent us a lamb and bowl of sour milk, the latter a great luxury after a hot march.

Leaving most of our party bivouacked on the margin of the Tarmiyeh, we cantered to the high banks of the Nathriyát, from whence a good view of the country was obtained, though our proceedings evidently alarmed the inmates of some camps of the Khasrej and Makadmeh Arabs, which are at a distance on the desert to the West. Setting up the Theodolite, through its telescope we could see the men girthing up their horses, kept constantly saddled at the threshold of their tents, for

* Abu Sakhr, evidently a modern name of the wandering Arabs. Sakhar صخر has reference to the "gravelly" or "pebbly" nature of the soil in this part, and Abu, "father," is the usual metonymic epithet in vogue amongst these ignorant people. Rendered into English it conveys no meaning whatever, and is used much in the same way as a familiar insect, a species of Arachnidæ, is known to the English school-boy by the title of "*daddy* long legs."

† They accompany the paper, and to any one learned in these ancient symbols they might convey the era of their locality,—as monograms on coins, in the absence of their legends, enable us at times to identify the period in which they were struck.

pursuit or attack of the foe, while the women were giving the alarm to the shepherds and those in charge of the camels, to hasten the gathering of the flocks around their respective hamlets, before the expected swoop be made upon them by the hawks of the soil. When these had been called in, they felt themselves comparatively safe, (for the plundering parties seldom attack a pitched camp unless professedly at war, knowing the hearth will be defended to the last;) they sent out scouts to ascertain the nature of the alarm. Seeing, however, that we kept our position, and fearing an ambuscade in the bed of the canal, they stood aloof at a wary distance and keenly watched our proceedings. In the mean time we had obtained a good set of Azimuth bearings and a round of angles to all the objects within range of our view, * and descending the mounds after the sun had set, soon lost sight of our alarmed friends by a retreat upon our own position, where the evening meal enflanked with bowls of buttermilk, spread out on the rich green sward, awaited our coming. Going through the necessary ablution, the fingers were speedily in action in doing honor to the lamb of our entertainers, the Khasrej having, at the same time, an occasional regard to the cool liquid within the capacious bowls by our side. We enjoyed this the more from a contrast with the gloom and bad fare of the preceding night; for now a brilliant moon floated overhead, and the night was of that mild kind that we slept in our clothes upon the carpets, without other covering of any sort.†

The following day (March 23rd), after the latitude had been obtained, we quitted the ruins of Abû Sakher, first replenishing our water-skins from the Tarmiyeh Lake. Our course was now N. by E. (true), over a country that at one time had evidently been well watered, but now as bare as a snow tract with the exception of the broken pottery with which it was strewed, and which marked it as the former abode of a

* Appendix J.

† There is something undefinably pleasant in nomade life, and in bivouacking in the open air, for there is a sense of freedom and independence connected with it scarcely imaginable by the dweller in houses and the occupant of confined rooms. The air too is deliciously pure in these wilds, and coupled with the invigorating march from day to day, would, in the winter months, soon restore the most enervated invalid. I have often wondered, indeed, that Indians, in search of health, have not wandered as far as Mesopotamia, where, in addition to the health restoratives recorded above, so much is to be found to interest the traveller's *ennui*. Darwin, in his instructive and amusing "Journal of a Naturalist" characterizes these wanderings as "inexpressibly charming" pages 69 and 257, and I quite agree with him. To be able to pull up your horse at any time and say "here we will pass the night," away from the cares of life and the bustle and ceremony of crowded cities, is a luxury indeed, and an unknown one to the inexperienced.

numerous population. Twenty-two minutes' march from Abú Sakher brought us to some heaps of bricks that pointed to the site of a village of a more recent date, yet perhaps of the age of two or three centuries back,—these ruins are termed Walaiyat Zahéyrí,* and a deep dry hollow to the S E. was pointed out as once the position of the Zahéyrí Lake: it doubtless joined that of Tarmiyeh, and, I understand, was the reservoir which received, in the flourishing period of the Dijeil Canal, the superfluous waters of that stream, during the spring rises of the Tigris. Continuing on towards Kef Ali, we passed several tumuli of ruins that connected Zahéyrí with the old town of Akbara, whose ruins we reached in exactly an hour from Abú Sakher. The tomb of Kef Ali, a very venerable building fast tottering to its fall, is the only erect portion of this once magnificent town, whose mounds now cover a space scarcely credible, considering the modern aspect of the country and its dwindled population. The Tigris, as it swept onwards in its ancient bed, washed the walls of this great city, separating it from the Walaiyat Zahéyrí, (probably the suburbs of Akbara.) Akbara itself was divided by a small stream called the Shatayt, or lesser river, whose deep but dry bed is now seen winding to the SE. onwards towards another ruined city, that of Waneh, also a celebrated spot in the more recent history of the country, finally to join the larger bed, at a little distance to the South. This latter is, however, very indistinct in the neighbourhood of Akbara, for the Dijeil irrigants, when they reached thus far to the SE., were brought into its channel,—the spade and the ploughshare in a great measure obliterating its course, and turning its ample bed that was formerly covered with waving masses of water into fields of waving corn,—in their turn again to become an uncultivated waste, now unblessed with a drop of the element with which it was once so richly endowed.†

* ولاية This word here signifies "a lord or master" the name is applied also to "dominions."

† Thus nature changes her aspect, and works out the great problem of our existence. Smiling fields and green pastures become a wilderness, and refined kingdoms merge into barbarous states, in order, perhaps, to establish a progressive civilization, which we have seen for ages spreading from East to West,—leaving those that were the most enlightened so far back in the shade of years, that were it not for history they can scarcely be recognized as the parent stock of the many races now inhabiting our globe. In considering the various phases which nature has assumed in this country, too much has perhaps been attributed to prophecy, especially by the modern writers, who to carry out a text of Scripture have, in some instances, been so keen of perception as to see in detail, at the present day, the whole of the

Akbara, though but partially noticed in any of the MSS. which I have been able to see, must have been an important place, if we judge from the extent of its elevated heaps of ruins alone, and owed its

evils the inspired writers have denounced against fallen Babylon. It requires little foresight, indeed, to depict the destruction of cities situated on the margin of great rivers, such as these, particularly when the authorities and people are either so absorbed in luxury, or are so apathetically indifferent to the destruction annually going on from natural causes alone, as to neglect the necessary precautions for the public safety, which, daily endangered, is unheeded, though both foreseen and foretold. Universal and sudden ruin must succeed to such neglect, and cities thus thrown down by the waters are no longer habitable places for man, at least for some time to come. While, however, acknowledging the wisdom and inspiration of the prophets of old, we can hardly help smiling at the zeal of many who have endeavoured to develope the accuracy of their predictions, sometimes perhaps at the expense of truth, and at others, regard ess of the ridicule which such morbid narration must excite in persons who follow in the same path. These thoughts have been suggested by seeing, in a recent excellent work (Kitto's Biblical Cyclopædia, under the head of Babylon), a plate of the "site of Babylon," with a maned lion of the African species proudly occupying the crest of the ruin it pretends to represent. Independent of the species being unknown in this country, I am led to believe that the habits of the animal would not induce him to select so prominent a position as the brick summits of these elevated mounds. The learned compiler, however, has been drawn astray, I consider, by the too forcible description of Sir R. Ker Porter, who distinctly states to have seen "*two or three majestic lions* taking the air upon the heights of the pyramid of the Birs Nimrûd." Having visited this ruin frequently, at all times of the year, and moreover heard the expressed opinions on this subject from many others who have wandered over these desolated heaps, I cannot help regarding the excellent and generally accurate traveller's "*lions*" as nothing more than jackals, or at most hyænas, which certainly are to be found not only in these ruins, but in abundance in the surrounding country. I do not say the lion does not exist in the vicinity, on the contrary, it is to be found both on the Euphrates and Tigris. Its habitation, however, is not among the ruins, but in the tamarisk groves that form the strips of jungle along the margins of these streams; and perhaps Babylon, from its being occupied by the modern Hillah—its gardens and cultivated tracts, both above and below the town—is the least likely place to meet with this animal. I have seen it to the North and to the South of the historic site, but never in any part usually considered as Babylon Proper. It is a fallacy, too, to suppose that "the Arab does not pitch his tent there," for encampments, flocks, and cultivation, may be seen in various portions of the open spots of country, particularly during winter, when a shelter is obtained beneath the mounds from the cold NW. winds. It may be argued that the prophecy alludes to the mounds themselves, if so, as I said before, inspiration is not needed; for any one may augur that the Arab will not pitch his tent upon fractured bricks and broken glass, which, however well adapted as a suitable bed to the blind zeal of a devotee, but ill accords with Arab notions of ease; for though regardless of luxury, their camps are not devoid of the comfort a smooth plain will afford, nor indeed do these materials of the mounds constitute them the best pastures for cattle, nor—by reason of the nitre and ammonia in the soils covering old cities—is the earth best suited for vegetation; yet there is no want of it in the spring and autumn, when the tribes are at peace with the Government. Sir Ker Porter may have visited these plains when it was not seed-time, and thus drew his conclusions of the "ground being naked of vegetation," too hastily. The description he gives of the face of the country, "its half clay, half sandy surface being left in ridgy streaks, like as is often seen on the flat shores of the sea after the receding of the tide," being the actual furrows left by the plough-share of the preceding year, softened down only by the method of irrigation and the muddy nature of the soil, and not the effect—as he would wish to convey—of wave-like rippling caused by a sea of water, though doubtless it is inundated, and that frequently, but not more so than other lands in both the Euphrates and Tigris—indeed, less if anything—the sites of old cities being generally, from accumulated debris, on a higher level than the surrounding country. This aspect of the soil, indeed, is peculiar to the highly cultivated districts, and in fact, instead of witnessing to their utterly desolate state, tends to overthrow the conclusions of this observant traveller, and to show that too great a zeal, although in an excellent cause, may not always carry conviction of the truth, while, at the same time, the spirit of the prophecies may have been sufficiently well carried out, before our day, to prevent scepticism, or indeed may, for what we know, yet require to be fulfilled. There are, in sooth, many popular errors abroad relative to the present "*status loci*" of fallen Babylon, in connexion with some of the solemn denunciations recorded against it in the pages of Isaiah, (chap. xiii. v. 20, 21;) and Mr. Rich, in relating the tale of the Chokadar (page 30,) probably in accordance with the taste of the times, has thrown a degree of credit upon the existence of satyrs, dragons, and other doleful creatures on the spot, which, with a little inquiry, he would have found—when divested of Oriental exaggeration—applied to the common hyæna of these parts, and to no other beast. The right half of the carcase of this animal, longitudinally divided, is eaten by the Sunnis, the other portion being considered as unclean, in accordance with the law of the Koran, as interpreted by the Sunni sect of Maho-

abandonment, in all probability, like the other towns in its neighbourhood, to a great and sudden change the Tigris underwent,—but at what precise time it is impossible to say. Abulfeda, who wrote at the end of the seventh century of the Hijreh, notices Akbara عكبرا as a mere village only in few and concise terms.* It probably derived its water from the Dijeil Canal, and so long as this great conduit remained capable of fulfilling the design for which we may suppose it was excavated—that of supplying the town recently bereaved of the element by the great change of the course of the river —we may presume that Akbara continued to be inhabited.

It is idle, however, to speculate farther on its history, though it doubtless existed *in situ* prior to the Mahomedan conquest, perhaps under a different name. We have a notice of the place also in the geographical work entitled Márifet-al-Buldan of Ibu Hookal, who wrote in the first third of the tenth century of Christ, and who merely mentions it by name with several others,—concluding the meagre list

medans; the Shiahs, however, refrain from its flesh, deeming it entirely prohibited. There are some tribes of Arabs, finding that opinions clash upon the subject, wisely enough, when hungry, devour the whole; the Jebour, indeed, seem to have a relish for the flesh of the noxious animal. The peculiar formation of the hind-legs of the hyæna, coupled with the fact of its being a semi-edible brute, and an inordinate desire for the marvellous in all Orientals, have induced the worthy Chokadar to exercise his powers of invention, probably after inquiry had been made on the subject by Mr. Rich or some of his party,—for these people will readily affirm to anything, however surprising, if a leading question, apparently of interest to the querist, is put to them to solve, and indeed will not fail to embellish it with some crude and preposterous remarks of their own, that in most instances secure for the rest of the tale the discredit it is generally entitled to. As a myth, however, the satyr is not unknown in this country, and has held its place, doubtless, from the most ancient times; for we find it represented on the cylinders and gems peculiar to ancient Babylonia, and in the imagination of the inspired writers was perhaps invested with the same powers as the "jins" and "dews" (genies and evil spirits) are supposed to possess among the more enlightened Mahomedans of the present day. Formerly, from a want of a thorough knowledge of the Hebrew term *tzabwâ* צבוע the hyæna was supposed to be unknown in Asia, and as Pliny (Vol. I. Book 8, Chap. 30) described it only as a native of Africa; its presence in the East in remote ages was once doubted by a naturalist of distinction, (Col. Hamilton Smith.) Though little known, perhaps, from its nocturnal habits, it was doubtless much dreaded, and may have supplied a type for the term "Satyr," as rendered in our version of the Scriptures, in which the hyæna is named but once in the Greek text of the Apocrypha by the name of Ὑαίνα. (Ecclesiasticus, xiii. 18). At the present day the animal, amongst the Orientals, has ascribed to him the same salacious powers as the Σατυρος of Greek fable was supposed to enjoy, and in this respect amongst the ancients doubtless it held the same place, from the peculiar perineal glands with which it is furnished by nature. Its habits in other respects—associated with imagination—lent an ideal picture sufficiently corrupt and alarming to create either terror or disgust in the minds of all men. There are some Arabs even at the present time, who suppose it to be so far a distinct species from other beasts, as to be able to change its sex at will. The Arabic name *d'thab'a*, ضبع meaning alike "hyæna" or "lust," shows at once its close affinity to the Hebrew.

* In the Taquim-al-Buldan, where Akbara is described as ten farsakhs from Baghdad. This gives a value of 5,062 yards to the farsakh, or 2 English statute miles and 1,542 yards,—equivalent to 2¼ miles geographical, exactly. Abulfeda's information on this head is derived too from the lubáb or "choice" pieces of a work called Kanum.

with the brief information, "these towns are nearly equal in *greatness* and in *littleness*."* It is named, too, in a manuscript work entitled the Kitab-al-Akálim, by an anonymous writer, who is supposed to have compiled his description of the Euphrates and Tigris about five centuries back.† Beyond the name Akbara, amid a catalogue of other towns, standing on the banks of the Tigris, we have however nothing recorded, and Mas' Udi, though he notices Tekrit, Sámara, and Baghdad, on this portion of the Tigris, in the only book of his that I have access to, ‡ is provokingly silent with regard to other places which, from their size, must have been almost equally distinguished. From this I conclude they had dwindled into mere villages in his day, § (A. H. 332,) not worthy of even a passing glance.

The neighbourhoods of Akbara and Wáneh are much visited by parties of the Bedoin Arabs, who remain concealed among the ruins, in hopes of meeting with caravans of pilgrims that sometimes venture to use this road on a devotional tour to Samara. The tomb of Kef Ali affords a hiding-place, and a well, excavated in the old bed of the stream as a pious work for the use of these religious way-farers, renders it a fit 'hostelrie' for the nomade robber. Some fifteen years ago Ali, then Pasha of Baghdad, placed a garrison at Wáneh, in hopes that its presence would deter these banditti from infesting the Dijeil districts, the garrison being supplied with water by a cut from that canal re-excavated at the expense of the Government. The precariousness of the

* See translations of Ibu Hokal by Sir W. Ouseley D'Herbelot, who, in a notice of this geographer styles him "*fort prolixe*." His descriptions of the towns on the Tigris are certainly otherwise.

† We have enumerated in succession in this work, below Sàmara, the towns of Qádesiyet,* Al-Ajmeti, Al-Alth,* Al-Khátireti. Al-Suwámà, Akbara,* Awáneh,* Busrey,* Yezúghí, Berdán, Mezrakah, Katirbal, Shemásiyeh, then Baghdád, which is named the "city of peace," divided by the Tigris. Of this extensive list I have found five only—those marked with the asterisk—retaining their ancient names in the country, independent of Baghdad, but hope to assign a locality to the rest before long. These doubtless were in ruins long before the Kitáb-al-Akalim was compiled, or perhaps were then merely eking out a bare existence, (many of them, under another name,—) after the excavation of the Dijeib Canal had in some measure restored the supply of water so much needed subsequent to the irruption the Tigris made to the Eastward. The author doubtless collected his names from existing works, when describing (in general terms only) the Rivers Euphrates and Tigris. I am, indeed, led to think that their more prosperous days had passed prior to the Islam period, from the words of Masúdí, in Chap. xi. page 264 of Springer's translation, which I shall subsequently refer to at large, when considering the site of Opis, and the great damage the country sustained by the destruction of the Kátul-al-Kesráwi Canal.

‡ "Marúj-al-D'hahab wa m'aa den aljahir;" this however is a general history, and but casually treats of geographical subjects. I have tried in vain to procure the Akhbarez-zamán, a pure geographical work by the same author, in detail, where doubtless he is more explicit; I believe it does not exist at present in Baghdàd.

§ Wáneh, or Awáneh as it is written in the books, is an old city about a mile to the SE. of the Akbara ruins on the old course of the Tigris. I have not yet visited the spot, but shall take an early opportunity of fixing its position.

supply, cut off as it was sometimes by obstructions, at others by a scarcity in the canal itself, soon made the modern fort—built on the site of the ancient town—an untenable position, and it was therefore abandoned almost as soon as occupied. Many believe, however, that the threats of the Arabs had more to do with the evacuation of the place than the necessity mentioned, and the whole job appears to have been one of those wisely conceived designs the Turks are so fond of practising, without considering their feasibility or disadvantages beforehand. Had the fortress, indeed, been built around the well above mentioned, the Arabs would have been deprived of the article so much needed in their predatory excursions, and this alone would have effectually deterred them from making any stay on the spot. A casual visit even to their hiding-place, the tomb of Kef Ali, * would have been attended by risk to themselves, for the well is within point-blank range of the building, and a shell or round—shot, expertly thrown, would have carried moral weight with it for a long time in advance. Turk-like, however, remedies for existing evils are seldom thought of, and when undertaken are executed by that happy mode denominated by sailors "the rule of thumb"—a rule, however ingenious, is about as efficacious as the tall Irishman's plan of unwillingly curtailing his blanket at one end to lengthen it at the other, so as to keep the cold from his feet, which had become half frozen from a too contracted covering. The result of these feeble conceptions and half-executed measures is to embolden the desert tribes, whose annual encroachments are made with increased daring, even in peaceable times, within a few miles of the seat of Government, while, when rebellious, their forays extend to the gates of the capital. As an instance of this, the direct road to the Dijeil, which we are now following, has been closed to caravans from the danger apprehended, and

* The cupola of this tomb has at one time been surmounted with a neatly carved block of white marble, highly polished, and of the finest grain; it now lies within the tomb, having, by its weight, fallen through the crumbling roof. The name *Kef Ali* كف علي applied to many places in the country, would seem to signify that some one of the soldiers or companions of the famous Ali, the son-in law of the prophet Mahomed, was interred here. The present ignorant people, however, imagine that the building was erected to commemorate a miracle, worked on the spot by the first proselyte to the doctrines of Islám, whose hand (*Kef*) is the member from whence its appellation is derived. Ali was, I believe, never so far North as this place, but his virtues in all likelihood have been venerated here in the person of some other chief,—indeed on the one perhaps in whose favor the reported miracle was performed. I procured a set of good bearings from the top of the tottering building; these will be found in Appendix under head K.

the produce of the district, protected by the canal, has generally to cross the Tigris to follow the Eastern road to the city. Even among the smaller tribes of the Khasrej and Wakadmeh, located on the line of route, an almost constant fear is entertained for the safety of their flocks, which are swept off from time to time by detached parties of these plundering hordes. We hear that a band of ten horsemen were seen last night concealed in the neighbourhood of Nathriyat; but from circumstances mentioned by the narrator, we believe our party to be the innocent cause of the existing alarm. An old syed, who acted as spokesman on this occasion, showered on the heads of the villains who showed themselves on the horizon of his vision, the previous evening, a string of abuse in the choicest phrases the Arabic affords,—calling *Allah* to witness that if they came again to disturb the peace of the camp he would personally cut the throats of the whole band. This seemed to give him infinite relief, and though by no means courteous to ourselves, as we were the culprits, it was smilingly listened to, especially as we had witnessed the vaunting old fellow's prudence in keeping aloof the night before, when but the show of attack would have scattered any number so small as our own, to seek safety at the expense of horse-flesh. I must say, however, that this caution in them is not the effect of cowardice, but is caused by the dread of subsequent retaliation. A visit from the powerful tribes to whom these parties are allied would occasion a blood-feud, in all cases attended with the greatest evils to the weaker party.

From Akbara to Sumeychēh it occupied us an hour and forty minutes. The whole distance was traversed by the lines of deep and extensive canals, and the appearances of wasted fields, on either side as far as we could see. These canals all led from the Dijeil in the flourishing period of that conduit, but the decreasing supply in the trunk stream—neglected as it at present is—has caused these fine irrigants to be closed for a long time past. They bear evidence, however, to the former fruitfulness of the Dijeil districts, whose attenuated stream now but barely reaches to Sumeycheh, and that for a few hours only in each day, according to the height of the Tigris from whence it is led; for the villages in its course to the South have their regulated hours also for the enjoyment of the element, which is very sparingly distributed. In the more prosperous days of the Khalifs, when the broad channel of the Dijeil was nearly

connected with the waters of the Tigris, through its South Eastern irrigants, its waters not only supplied the towns that had been isolated by the great change the Tigris made to the Eastward, but acted also a defensive barrier to the suddenly bereaved cities, and the immense tract of land which, by the irruption, had become the property of the district. Protected by this stream to the West, and by the new course of the Tigris to the East, the included space doubtless became the resort of the peaceable landholder and cultivator, for the security it afforded. A glance at the map will show the value of this isolated portion, yet strange to say, the present Government pays but a slight regard to its naturally secure position, where a judicious expenditure, coupled with an earnest attention to the improvement of one spot, would at once show how the resources of the country could be again adopted for the obtainment of vast revenues such as it formerly enjoyed, instead of the exchequer being kept at its miserably low state from year to year, by hard wrung and difficultly collected drainings, in the shape of taxes and tribute, from places separated by tracts of desert from each other, and from people who, confiding in their distance from the seat of Government and the weakness of the authorities, contribute no more to the State treasury than suits their taste for idleness and exemption from the visits of the soldiery. In Turkey, more than in any other country, these visits are as dilatory as ineffectual, though for the time they occasion inconvenience to the Arab, insomuch as the tribe has to quit its territory, which alone embarrasses a community, for, in addition to the domestic disturbances occasioned by the movement of flocks and herds into less favorable pastures, it frequently embroils the tribe with neighbouring families, at a time when harmony should prevail. Thus idleness and a partiality for the domestic soil on the one hand, combined with the absence of *morâle* in the constitution of the Turk, and a want of ethical knowledge in the government of states on the other, forges a political link of union which, however corrupt, maintains the chain unbroken, though most galling from the necessity which gives rise to the mutual dependence. Were the present Pasha but disposed, the Dijeil would be easily opened to its former extent, and the small tribes, now annually in a state of starvation around Baghdad, would gladly avail themselves of its protection to people the spot; nor for this

reason would the locality be unregarded by the capitalists of the place; and in a short time we might hope to see its deserted towns restored, and its minor irrigants re-opened for the encouragement of the few industrious agricultural families that are met with. Example would then work its effects; population would increase; and a moderate taxation, exacted with strictness and impartiality, would soon swell the exhausted revenues. Security of property must, however, be first guaranteed by the strong arm of the law, and the existing corruption in all classes, and in all offices, must be gradually eradicated. A small place like this, amply surrounded by water, is a fit spot for the introduction of improvement, and I feel confident of its progressive character, if some enlightened Pasha would devote his energies to the task. He must, however, combine *in se* both statesman and soldier, freeing himself in the first instance from avarice and pride—those great vices of Turkish national character, and like Peter the Great, must devote himself entirely to the task of regeneration. A lamentable want of energy in the present ruler precludes a hope of this for the time; but while recording this failing, it is but fair to state, that the vicious stumbling blocks to amelioration and improvement are alike absent in his character, which, while noted for good nature, is remarkable for taciturnity, and a child-like simplicity of manner. The capital of the Dijeil district is now represented by the miserable village of Sumeyeheh,* enveloped in a date grove, the first on the West side of the Tigris, above Kathemein. It numbers at the present time about 200 mud tenements, inhabited by cultivators principally who are of the Shiah sect of Mahomedans. It boasts of a mosque and "serai," † the minaret of the former being a stunted pillar fast falling to decay, and within a year, in all probability, will be numbered with the things that have been. The date-trees, formerly so thick, are now few and far between, and year by year are decreasing from the pervading neglect. Some enclosures surrounding the village, courteously styled "The Gardens," boast of a few pomegranate trees, which are nearly hid from the passenger by the great height of the mud walls that enclose them. These speak of the character of the Sumeyeheh people, who are reputed

* Sumeyeneh, I am inclined to think, stands upon the site of Suwáma.

† Serai سراى "palace" a Persian word in common use both by Arabs and Turks. It is applied also to any mansion, however small, in which the chief of a town or district resides. The place in question differs only in its construction from the rude dwellings around, in having the doorway and one room only built of burned bricks.

admirable thieves, and covet, in no ordinate degree, the property of their neighbours. Its population is composed of several tribes; among others, fixed residents from the pastoral and agricultural families of the Khasrej, the Wazùn, the Babilin,* and the Sáfiŷeh—who here, as schismatics, enjoy unmolested the opinions they have imbibed. Like all other lands in this part of Turkey the district is annually farmed to the highest bidder, who, without reference to his abilities and character, becomes at once in his own person proprietor and farmer, tax-gatherer and assessor, as well as magistrate, jury, and sometimes executioner, in all cases but those of life and death. The present functionary, or Zabit † as he is termed, is Tâhir Aga, a descendant of one of the old Baghdad families, and has held the district for two successive years, contracting to pay to the State in this period the amount of forty lacs of riege Piastres, a nominal coin, equivalent to a sum of £877 sterling. Here then is a district that encloses perhaps an area of 200 square miles, of the finest alluvial land,—than which, I believe, there is none more productive —and surrounded on all sides by water—paying about £4 10*s* per square mile, which, instead of an iron plough, so soft is the soil, requires only a pointed piece of wood to turn up its surface for the purpose of the cultivator. The water too, flowing from a higher level, needs only an excavated path to traverse it in its whole extent, with no other trouble than that of keeping the aqueducts clear to render the irrigation complete at all times, and yet no heed is taken to the re-opening of the Dijeil Canal, whose wire-drawn streams can now be stepped across by a boy at Sumeyeheh, while in by-gone times they swept onwards through the lateral ducts, even in brooks some yards in extent.

On leaving Baghdad the Pasha had kindly furnished a letter to the Zabit of the district, "who now invited us to take up our abode in the "Serai," the best accommodation the miserable village afforded. Declining the intended courtesy, however, we selected a flat sward

* The late Dr. Ross mentions these people in his journey to Al Hadhr, noticed in the *Jour. R. G. Soc.*, as the descendants probably of the original Babylonians. The only information I could obtain regarding them was their having originally come from the neighbourhood of Kerkuk. The name is recognised by the Arabs as an ancient one and its possessors are no doubt in some way connected with the original stock that peopled the Fourth Climate, as the ancient Persian geographers denominated the Land of Babel.

† Zabit صابط signifies a "master" or "superior," and is used in Turkish Arabia to denote the "chief" of the district; he is generally also the proprietor or farmer of the soil.

on the skirts of the village, where we at least could inhale the pure air of the desert instead of the accumulated odours of the cow-house and stable—the apartments generally approximate to the Arab village drawing-room, which in itself, if not of impure Augean stamp, is so crowded with living specimens of inferior zoology, as to lead to the belief of your having stumbled by accident into an entomological museum, and were doomed to suffer for the mistake a personal introduction, not *to*, but *of* every little member comprising the community, for you are assailed on all sides at once. I had often thought, indeed, that the Arab generally was the greatest idler in the creation, but more than a casual glance has since convinced me of my error; for these tormentors of his race, which Nature has amply provided, afford him a constant occupation. It would be matter for speculation, perhaps, to consider how far this has interfered with the performance of works of more general utility, but as the night is waning and my companions already buried in the oblivion of sleep, I will let these thoughts take the same course, while I stretch myself out in the attempt to follow them,—first, however, examining my instruments for to-morrow's journey, for my late reflections are due to the slow passage of Sirius (*canis majoris*) over the meridian of my carpet, spread true East of Sumeyeheh minaret, which consequently is in the same latitude.

The following morning (March 24th) being anxious to obtain a good set of bearings, after sounding the people with respect to the propriety of ascending the minaret, for this purpose I set off for the mosque, and from the broken gallery had a good view of every remarkable object in the vicinity—not, however, without imminent risk of a broken neck, for a ledge of brick about two feet broad, without protecting sides, alone conducted round the summit of the minaret, and thus compelled me to proceed, as bearing after bearing was taken, with my back against the upright shaft, and a clear drop of sixty feet into the court-yard of the building below me. It was a ticklish task, and I was not sorry when it was completed, and merely mention the circumstance from the sensations. I felt according with what I had before heard, but could never comprehend. On this occasion an almost irresistible desire seized me, not to precipitate myself headlong down, but

* See Appendix L.
† See Appendix M.

something I cannot describe that was almost akin to it. It may have been partial giddiness, but I was aware it required all my presence of mind to keep the horror of the fall, the restraining thought, foremost in my memory. I verily believe that had I allowed the sense of impending destruction to escape, the former impulse would have precipitated me into space, the next instant to fall a corpse on the flags below. Perhaps the circumstances of knowing there was but one door, and that I had already proceeded half the circuit of the pile from it, and out of sight of my companions, tended to claim me at the height I was. I even dreaded to lean too hard against the shaft for fear of recoiling forward, and went along sideways in this embarassing position, until I made the circuit of the building, and caught behind me the lintel of the low door-way. Certain of being safe, these almost overpowering thoughts at once left me; but I never reflect on the outward position I was then in, but the same thoughts, in a less degree, will intrude upon me, though I never experienced the like sensations before, in many similar positions, and may never do so again. I leave it to others to account for the singular feeling, for I am unable, though inclined to attribute it to some unknown but morbid state of the stomach at the time. My impression, however, is that many reputed suicides have resulted from similar affections on the brain of individuals whom, perhaps, of all others, may have been most unlikely to commit self-destruction; nevertheless, the press in many cases would teem on the following day with previous facts corroborative of the hallucination that led to the attempt, while, in reality, the intellect of the suicide may have been perfectly sound to within a few moments of the catastrophe.

Soon after our return from the spot which led to the digression, the Zábit of the district favored us with a visit, and at the same time provided a sheep, firewood, and other necessaries for our entertainment, free of expense, in accordance with the established laws of hospitality. These we were not strictly entitled to, for we had declined his proffered civilities on the previous evening, principally from a distaste of the custom which, *among Turks*, is generally made at the entire expense of the poor, or at much less a cost than the value the articles are priced at. We found our visitor agreeable enough, though at first he wished to convey an idea of his importance by a taciturn gravity that sat but ill

upon him. Soon aware, however, from the style of his reception, that his inflated manner was inappreciated, he became affable and conversant. He informs us that the clearing the canals cost him a sum equal to £500 before he commenced farming the land to the tenants, and the Tigris has not yet risen, as usual, to render them effective. The sum looks small, but when the size of these petty irrigants, cut through a soft alluvium as they at present are, is considered with reference to the amount of profit, after paying the purchase-money, it is reckoned a great outlay, and a dead loss to the proprietor, who this year is otherwise unfortunate, there having been a dearth of rain throughout the season. Furnishing us with a guide, and letters to the chiefs in the North of the district for our reception in their various localities, he took his leave, and immediately afterwards we were called upon to give the customary donation to the bearer of the edibles sent for our consumption by the chief. This donation is generally made with reference to the value of the *presents* received, which in liberal Turkish houses is *bonâ fide* the perquisite of the servant bringing them; among public functionaries, however, of this class, the owner, as in this case, considers himself fortunate if he is selected as the bearer, for he meets with a return for the forced hospitality of his master, who doubtless is equally pleased at the *finesse* he had displayed in obtaining a character for generosity without detriment to his own pocket. With Arab tribes of any pretensions to caste, the act of feeling the dependants is considered as an insult; indeed, among the Bedoins, the lowest followers, having the character of the tribe for hospitality at heart, will not accept it, for, thieves as they are by profession, the money thus earned would be deemed a pollution; with the Turk, however, it is far different; men, of the highest class even, not unfrequently resort to this plan for paying a numerous class of retainers whose sole gains are the received fees of guests fed in their master's house upon forced meats, often enough levied at the command of the seemingly generous entertainer.

Shortly after the noon observations for latitude had been obtained we left Sumeycheh, under the conduct of Husseyn, a new guide, and keeping a course of N. by E. generally passed over deserted beds of cultivation, and ruined walls, that proclaim the abode at one time of an extensive community. The ground, however, was arid and parched,

though traversed with minor branches of the Dijeil, which, not many years previously, had been open, but were now closed. In an hour and ten minutes we came to the deserted villages, called Wázun and Safiyeh, from agricultural families of these tribes formerly inhabiting them. These stand upon the site of an ancient town * which encompassed a quadrangular fortress, of great apparent antiquity, whose remains, worn down to a high tumulus, similar to the strongholds seen in the plains of Shahri-zur,† are quite distinct, having a deep hollow in the centre that evidently marks the side of the well from whence its garrison derived the supply of water in times of strife and confusion. It is now called Al-Hyr, ‡ and nothing is known of its history at present either directly or by tradition. NNW. of this position, a mile and a half distant, we came upon the well-known line of an ancient canal, of considerable size, stretching from the NE. It can be traced, in a direction of 240°, to the old bed of the Tigris. It was recognized instantly as a branch originally emanating from the Katul-al-Kosráwi, the large conduit now on the other side of the great river. The Tigris indeed, by its irruption to the East, separated this and many other similar branches from the trunk-stream, causing universal destruction at the period. The guide erroneously styles it the Nahrwan, though the name is conclusive of its origin. Its singular position, lopped off it is from the great artery, and standing immediately to the West of the small dry bed, called Shatayt, shows that the latter water-course is of comparatively recent date: we can see its windings about a mile North of our present position, and about the same distance to the East, where it severs the canal. Proceeding onwards in a line of North, as near as possible, in ten minutes we crossed the dry bed of the Shatayt, and in an hour and five minutes beyond, the broad stream of the Tigris was gained, immediately to the West of the opening, or depression rather, § from whence the Shatayt bed—on the

* See Appendix N.

† I have described some of these, at length, in a narrative of a journey through parts of Persia and Kurdistan. See *Trans. Bomb. Geo. Soc.* for 1848.

‡ This name, I believe, is sometimes applied to the old Persian fire-temples. There may have been one on this site in the Sassanian period. See also Appendix N.

§ This opening of the Shatayt will be found noticed by me on a steam tour on the Upper Tigris; *Beng. Asiat. Journal*, April 1847 *p.* 305. The stream at times carries away whole fields of cultivation, and joins itself with the waters in the Tarmiyeh Lake. I should have mentioned, when speaking of Akbara, that the Shatayt had been spanned by a bridge, for the remains of a solid structure are just discernible in its bed that formerly connected the towns on either bank.

formation of the new course of the Tigris, in all probability—derived its origin as a stream, only to be closed again when the large body of water in the Tigris had worked a depth of bed sufficient to contain it. At times even now, during high rises, the Tigris finds its way into this channel, and in such cases commits great havoc in the vicinity of the Dijeil, for many broad water-courses in the neighbourhood bespeak the nature of the ravages, and the people also confirm it.

We had been guided to our present position by the flags of the "Nitocris," which were distinctly seen from near Sumeyeheh, but were again lost sight of a little to the North of Al-Hyr, from the depression in the country, which I now think corresponds with the ancient debouchure of the Atheim River with the old bed of the Tigris. We were sunk in this depression when we came suddenly upon a caravan of pilgrims that had, an hour or two before, crossed the Tigris on their way from Samara to Baghdad. To pursue this route at all, they had to be well armed. Even as it was, it was evident they marched in continued fear from the alarm evinced at the *rencontre*, and our Arabs, seeing a party of Persians, were proposing a sham attack to enjoy the flight, which they felt assured would ensue on the charge being made. I would not, however, permit it, for the foremost of these way-farers were women and children—slung, on either side of their mules, in the peculiar cradle-like boxes called *kajavehs* in the country, the men bringing up the rear. When we approached, however, they rode to the front, and gallantly formed line on the flank nearest our party—each man, seated on his beast, bringing his weapon to the charge, ready to "present" in the event of hostile menaces on our part, and it was as well, therefore, that our advance was made in a peaceful attitude. It was apparent at once that these Persians were trained men, for finding a European at the head of the suspicious strangers, their confidence was restored, and lowering their pieces, we passed under a salute given in military style with the hand: a few minutes afterwards we exchanged similar salutations with a body of Persian gentlemen, the chief of whom was, I heard, a military Shahzadeh, or prince of the blood-royal of Persia, who with his relations and family were proceeding on a devotional tour to the various shrines of the martyred Imáms of his faith in the country. It is strong parties such as this only that can take advantage of this short route between

Baghdád and Samara. In the deep bight of the Tigris, South of Khan Dholóyeh, a ferry is established for crossing the river, and the road distance thus occupies twenty-three hours; whereas by the Eastern route, through the Khális district, it is generally a day longer. The position of this ferry is a well-defined geological limit, for here we have the last shingle islands in the bed of the Tigris, as it proceeds Eastwards, and the bottom changes, from the hard superimposed strata of the tertiary tracts to the muddy alluvium of the plains.

March 25th. Leaving the party encamped alongside the steamer, I set off this morning, with a few people only, to examine the locality; first proceeding at a smart canter to a conspicuous tomb known as Syed Mahomed's,* standing on the plain between the old and new courses of the river. Near it is a deserted Khán or caravanserai, built for the accommodation of pilgrims, but like most works of the kind, has been abandoned since the route has become dangerous. The tomb itself is a plain-domed building somewhat lofty, and has attached to it a place of prayer. The *facade* stands out from the building itself, and is not an inelegant piece of architecture, being three vaulted sections standing on a brick platform: the centre one supporting the dome is the highest, and a doorway opening at its back leads to the cemetry within. The face of the building is purely Saracenic, executed in a very neat style of brickwork, and on the entableture surmounting the centre arch, the words "*Yá Allah!*" O God! "*Yá Mahomed!*" O Mahomed! and "*Yá Ali!*" O Ali! are neatly inscribed by blue enamelled tiles that have been inlaid in the structure: the first pious ejacula-

* It marks the last resting-place of another member of the unfortunate race of Ali.

Syed (lord) Mahomed was the third son of Alí bin Mahomed al Juwad al Askeri, the tenth Imám, brother of Hassan al Askeri the eleventh, and uncle to Al Mehdi the twelfth and last Imám. The two first accompanied their father, the tenth Imám, from Medineh on his journey to Samara, then the recently-formed capital of Mátassem the eighth khalif of the house of Abbas, which place was appropriated as the residence of the Imám, while under a strict surveillance by the enemies of his family.

Sámara was destined afterwards to become the burial-place of the tenth and eleventh Imáms, who were supposed to have been poisoned, and the spot where the twelfth is said to have disappeared from the earth to re-appear at a future time as the Mahomedan Messiah. The tombs are annually visited by hosts of devotees of the sect of Ali, and are named "Al-Askeri" after the title of the family. I am at present unable to learn the reason of the Syed Mahomed's tomb being at a distance from the rest of his race, but suppose his death to have occurred while *en route* to the place of imprisonment. On a clear day, however, they are in sight of each other, being about 20½ geographical miles apart. This mausoleum must now have existed upwards of ten centuries, as the family reached Sámara about 214 A. H. For notices of this family see D'Herbelot, *Biblioth. Orient.*

A sketch of this tomb, presented by my friend Mr. John Taylor, will give a good idea of the edifice. It accompanies the paper—see Appendix O for the bearings taken from Syed Mahomed, which position is itself determined trigonometrically, with reference to the places situated North of it as far as Dúr, by my survey of last year.

tion being placed over the apex of the arch, supported by the others on either side. The building is enclosed within a square outer court, having cells in its walls for accommodation of the visitors.

Leaving Syed Mahomed, we next directed our course to the Eastward, towards some high mounds situated near the height spoken of before; about half way we crossed the bed of the Shatayt, which extends to the SW. It is distinctly traceable, and must have, for some time, held a considerable running stream. On gaining the mounds we found that five large canals had diverged from the spot in ancient times, the main one evidently the feeder coming in a perfectly straight line from 31°. This arm was subsequently followed to where the great irruption of the Tigris severed it in two,* about a mile and a half from this spot, its continuity being found on the opposite side of the river directly derived from the Katul-al-Kesrawi, and is positive evidence that the country now on the West of the Tigris, as far as the modern Dijeil, was cultivated, in its fullest extent, by means of the royal conduit of the above name, which indeed, contrary to my former opinion, must have received into its bed the greatest portion of the Tigris itself, otherwise the Katul and Nahrwán combined could never have supplied so many large veins, and at the same time have maintained their own character, as artificial fluviants, of depth and rapidity, through a country two hundred and fifty miles in extent. The breadth and extent of these derivatives alone are very surprising, and now impress me with a much greater idea than I formerly had of the magnificent works designed by the earlier monarchs of Persia, so as to reap the fullest benefits from the rich soil of the province.

Being now enabled to determine my positions from time to time, in consequence of having known points in view, ascertained trigonometrically in a former year, I was in a measure independent of astronomical

* The road-book kept exhibits the exact times from place to place, as also the bearings taken and courses made in the intervals of times. These are not shown in the narrative, as they tend to confuse, and at all times interfere considerably with the reading. The principal points are noted in the Appendix, with detail of the observations made at them. The filling in therefore is only shown on the map, to prevent prolixity on a subject which is always more or less tedious; in fact, terseness in the geographical description of a country that has seen so many changes, each partially marked on the map of nature, is almost impossible, especially when such little incident is met with to relieve the monotony of wandering from day to day, over a wilderness of ruins alternately varied only by arid and deserted plains. The amount of desolation indeed, is the single source of interest, and to a reflecting mind is, in itself, a treasury of history which though hard to decypher from the feeble light with which it is surrounded, yet calls for more than a passing remark of its superficial character, which generally offers so much sameness as to weary the mind that attempts the description, in the same way that the eye falls upon the monotony of the view.
See Appendix P. for the bearings at these diverging canals.

observations, and therefore left the chronometer which I had hitherto carried on board the vessel. Mounting shortly after noon, we resumed our examinations of the country in a direction of SW., and in an hour and ten minutes, having kept the windings of the Shatayt bed on our left, we reached a tumulus similar in all respects to Tel Hyr and, like it, evidently the remains of a fortress that had been surrounded by a town of some extent. The plain in its neighbourhood is strewed with brick and pottery in every direction, and the line of an ancient canal, just visible in the soil, shows that it was supplied with water from a duct of the great Katul, although the large dry bed of the Tigris, as it ran centuries ago, flowed close to its walls, a curve of it indeed winding half round the base of the mound. The ancient bed is here very well developed, being fully as broad as the channel of the present river, its windings exhibiting all the characteristics of a first class fluviant, so that it cannot be mistaken for the course of a minor stream. Tel Aabr, as this ruin is now called, doubtless marks it as the position of a ferry or a bridge in olden times. * It is certainly ancient, and has the remains of a well in the centre, for use in the event of siege. On approaching the mound, we rode forward at a smart canter, showing ourselves suddenly on the summit, to the great dismay of the inmates of a camp of Majummah Arabs that was pitched at a little distance on the other side. The women and children at once made off, leaving their tents and all they possessed to our mercy, if we had been intent on plunder. We had as usual been mistaken for a hostile party, from our abrupt appearance on the mound, and it took some time to convince the runaways of their error so as to get them to return. The men were mostly absent, or so much alarm would not have been shown. †

We now descended into the ancient bed of the river, and crossed to the West bank, which is of more elevation than the other, the country here bearing a different aspect altogether from what it has on the Eastern side of the course of the old stream, where the plain is a soft friable alluvium instead of a hard frebbly surface such as is now seen. It is evident this natural dip in the land had originally been the barrier of the Tigris to the West, perhaps from the earliest times, it being conducted into the low country this way on the same general

* Aabar, a "ford," or place of crossing.

† The bearing at this spot will be found in Appendix Q.

course as it is observed at the present time to run in, North of Samara and Tekrit. From the windings of its bed in this part, it is easily inferred that the stream had in a measure issued from the confined gorge of its own making that had restrained its impetuosity in the more elevated and rocky regions, and the curves all tending to the East show the line of least resistance to have been in that direction. This weakness in my opinion ultimately led to the great irruption the river has made to the Eastward, perhaps from a shoulder of the rocky superstratum, in the neighbourhood of Qadesiyeh, having suddenly given way under the pressure of so large a body of water, constantly impinging upon it from the firm and more elevated cliffs of a hard sandstone region which opposes itself as a barrier to the West. Along these the Dijeil Canal has been excavated, its banks being at times within a few yards of the ancient bed of the Tigris, and at others not half a mile distant, while below, in the neighbourhood of Sumeyeheh and Akbara, it would appear that the waters of the canal, having attained the level of the plains, were actually led into its channel.

Continuing along the bank of the old bed of the Tigris—now well marked either by cultivation or by the growth of an indigenous brushwood—we reached the mounds of another fallen city, equally extensive with Akbara, and exhibiting the same masses of prostrated buildings covered with slag pottery, corroded coins, and scoriæ, as are observable at that place. It occupies the space contained between the old channel of the Tigris, and the modern Dijeil. A few years ago a lofty minaret stood in the deserted city, which is named Harbeh by the modern Arabs; its pedestal is now all that remains to confirm its Mahomedan origin; I am of opinion, however, that the foundations of this town are of greater antiquity than this era, not only from the images of animals formed in *terra cotta*, which are found broken among the mounds, but from the appearance of an extensive platform of antiquated brick, which is seen a few yards to the West of a venerable tomb * known as

* The accompanying sketch of my companion Mr. Taylor represents this building only different from other minor Mahomedan tombs, in having the grave within diagonal to the square of the walls enclosing it. The sepulchre as usual points to the Keblah, in a direction of SW. while the walls of the tomb run in a line with the cardinal points. My ignorant guide can give me no information as to the history of the occupant Syed Saadi, nor can I learn the reason for the fantastic position of his resting-place. The bearings here are notified in Appendix under R.; the original of the two horned human heads in terra cotta, represented among the devices accompanying the paper, was obtained on this spot.

Syed Saadi, situated on a double mound formed by a quadrangle within a circular camp that in itself resembles a ruin of an earlier date. The lines of very old canals too are seen which passed over the site when they derived their water from the Tigris as it flowed contiguous to the town. During the Khalifate, however, the Dijeil supplied its wants in this respect, and it is not unlikely indeed, as I have said before, that to this and the other cities, bereaved of the river by the great change, the Dijeil owed its existence as a canal. The head of it leaves the Tigris in the neighbourhood of an ancient town called Istablat, or "*the stables,*" named thus, I believe, in modern days from the regularity of its streets which are disposed as a chessboard, in Arab opinion more resembling the stables in which horses are kept. Here the depth to which it was excavated, seen particularly at the ancient mouth opposite to Qadesiyeh, compared with the low banks not twelve miles lower down at Harbel:, is convincing proof of the great inclination the country takes in its change from the tertiary tracts to alluvium.

I can glean but little of the early history of the Dijeil Canal at present. The Arab geographers * that I have by me—Abulfedah and Ibn Hokal—just name it, the former as a canal abounding in towns and villages, the other among a catalogue of places on the Tigris, without any information beyond the general concise expressions that I have copied in a subsequent page. Its character however as a canal, so late as 629 A. H. or in A. D. 1213 can be read at Harbeh in the present day. At that time it rolled onwards in a magnificent stream, 50 yards in breath, and of a proportionate depth, but would appear to have been without any permanent bridge until the enlightened Khalif Mastansir B'illah † erected the work which the accompaying sketch represents as a specimen of the architecture in vogue during the decline

* At the present time, so impoverished is Baghdad in learning, and in every other respect, it is impossible to procure information on geographical subjects, nor indeed do the old works exist though it was once the academy of the East.

† Mastansir B'illah was the 36th Khalif of the 'Abbassin family, and succeeded his father Takir, being proclaimed sovereign in the year 623 A. H. He was celebrated for his great clemency and liberality. To him also authors ascribe the erection of the magnificent college whose ruin still remains remarkable for beauty of construction in Baghdad, and which bears his name. He is said to have erected many edifices of this kind, and the patronage he extended to learning and science in general was universal. The wealth of Baghdad in his day was immense, and in addition to the enormous revenues, there were treasuries heaped with gold and silver that had been accumulated by his ancestors. He thought only of expending them for the public benefit in the improvement of the country. In the latter years of his Khalifate the storm that had been brewing to E. and N.E., under the Moguls and Tartars, burst upon the provinces of the Khalif, but his capital was yet too powerful to be attacked by ill

of the Khalifate: it is most interesting, for of the few existing vestiges of these powerful princes there is not one-half so perfect or more elaborate in finish. It is built on Saracenic arches, having three minor arched sluices or ways intermediate with them,—the whole structure being composed of fine kiln-burnt bricks, of a large size and great neatness in fitting; a paved way, now in excellent repair, of 190 feet in length, 43 feet 6 inches broad, protected by solid parapets 8 feet high, led directly from the Town of Harbeh into the open country of Mesopotamia to the West. Between these parapets and the apices of the arches on either side of the bridge, occupying its whole extent, is an elegant Arabic inscription in relief composed of separate letters of brick neatly let into a frieze-work tablet, enclosed within an ornamental border of great taste and beauty. That on the SE. face of the fabric commences with the usual invocation to the Supreme Being, and goes on—after reciting precepts from the Koran continued in four verses extracted from the Surat-al-Hadieh, Surat-al-Amran, Surat-as-Subhan, and the Surat-al-Kehef, —to say, that 'The bridge is consecrated as a pious work to God (agreeable to the sacred words—the reward for good works will not be forgotten in those seeking for the paradise of Tardusi, the prepared residence for righteous believers) by our Lord and Master the Imam Amir-el-Moslemin ('Commander of the Faithful') the heir to the prophets and Marsilin ('apostles') the vicar (on earth) of the Creator of the Universe; the guide to manifest the true path of righteousness."—The Arabic original is as under:—

بسم الله الرحمن الرحيم واقيموا الصلوة واتوا الزكوة
واقرضوا الله قرضا حسنا وما تقدموا لانفسكم من خير تجدوه
عندالله هوخيرا واعظم اجرا واستغفر الله ان الله غفوررحيم الذين

disciplined hordes of the North. Sixteen years after his death, however, advantage was taken of the supineness and apathy of his son Mostassum B'illah, then Khalif, to invest the city itself, and after some time Halaku, aided by treachery from within the walls, made himself master of Baghdad, and of the person of the unfortunate Khalif. This was in the year 656 A. D. The treatment the sovereign pontiff of the Mussulmans received on his capture may well excite commiseration, though his conduct in some measure deserved it. Halaku caused him that had seldom been seen by his subjects (so great was his pride that he wore a veil on passing through the streets to prevent profanation, as he deemed it, by the gaze of the multitude) to be sewn up in thick felt to which ropes were attached for the purpose of dragging the unfortunate monarch through the streets of the city. He thus met a lingering death, and with him ended the Khalifate and the royal dynasty of the Abbassin, which had lasted, without intermission, a period of 521 years, in thirty-seven direct successions. [See Biblioth. Oriental. of D'Herbelot.]

ينفقون اموالهم بالليل والنهار وعلا نية ولهم اجرهم عند ربهم ولا خوف
عليهم ولا هم يحزنون ومن ارا دالاخرة وسعي لها سعيها فاولئك كان
سعيهم مشكورا نشاهذه القنطرةالمباركة تقربا الىاللهتعالي الذي لايضيع
اجرمن احسن عملا وطلبا للفوز بجنات الفردوس التي اعدها للذين
آمنو وعملو الصالحات منز لا سيدنا ومولانا اميرالمسلمين ووارث الانبيئا
والمرسلين خليفة رب العالمين وحجته ليبلغه علي الخير*

The legend on the NW. face is commemorative of the name, titles, and genealogy of the Khalif, Mastansir B'illah, and like most royal deeds savours much of self-adulation and pomp, at a time too when the faded glory of the Khalifate was on the eve of setting for ever. It contrasts strongly with the concise forms in use among the early successors of Mahomed, who used generally the simple but expressive distinction of *Khalif* only, with the addition at times of "Commander of the Faithful" as descriptive of their power.* The lapse of six centuries however, as in other barbarous states, had worked a great change in the primitive habits of the race. Humility and great abstemiousness, the characteristic virtues of the early Arab reformers, had been lost in the pride of conquest and possession, to be succeeded by arrogance, luxury, and princely display, that subsequently led to their overthrow and degradation. The following is the legend on the NW. face of the bridge †:—

الذي ايدهاللهٔ تعالى بعزاز نصرة الذين وافرض طاعته علي الحاظرين
ابن والبادين مختصه من جليل يعجزعنه حصرالعادين ابوجعفر
المنصور المستنصر بالله امير المؤمنين مكن الله له في ارضه تمكين الوارثين
ورفعهمقدرة اعما له الصالحت الى عليين وفشر بعدالة الزاهرة في
افاق الارضين واوضح للخلايق الرشد ومنهج الحق المبين الاميرالسعيد
البرالتقي ابى نصرمحمد طاهر بامرالله ابن الامام السعيد الزاكي الطا
هر الوفي ابي العباس الناصرالدين الله الامام السعيد الزكي ابى
الحسن المتقي بامرالله اميرالمؤمنين والخلفاء الراشدين الذين قضو با

* The address of the letter sent by the celebrated Hassun-ar-Rashid to the Roman Emperor, is a specimen of the laconic and contemptuous style of the early Mahomedan sovereigns. It ran thus,—"From the Khalif Hassun-ar-Rashid to Nicephorus the Roman dog."—Gibbon, vol. 6, chap. 52.

† I am indebted to the pen of Mr. Collingwood, of the Indian Navy, for the accurate drawing of the bridge of Harbeh.

الحق به كانو به يعدلون صلوات الله وسلام عليهم اجمعين وذالك
في سنة التسعة وعشر ين وسما يه وصلى الله على سيدنا محمد النبى
واله الطاهرين*

This is a somewhat free translation of the above :—"He whom the Supreme Being has chosen as the powerful protector of the religion, to whom obedience is enjoined both in those present and in those at a distance,* because of his eminent virtues and the restraints he placed upon evil men,—Abu Jafr-al-Mansur-al-Mastansir B'illah, Amir-al-Mumenin, (Commander of the Faithful;) may God establish him in his place, and confirm him in the seat that he has inherited, elevate him through good deeds to the highest sphere, causing by his enlightened justice a ray to dawn upon all men, so that through his direction a clear path of truth may be evident to all creation,—(son of) the equitable and pure Amir Abu Nasr Mahomed-al-Tahir, by the direction of God,—(son of) that sanctified, pure, pious and sincere Imam, Abu Abbas-al-Nasr-al'din Allah,—(son of) the devout and righteous Imam Abu-al-Hassan-al-Mattaki, by the grace of God, Lord of the true believers, and the successor of the faithful: guides in the path of religion, who acted righteously and with justice. The blessing and the peace of God be upon them. Performed in the year Six hundred and twenty-nine. The blessing of God be upon our spiritual Prince and Prophet Mahomed, and upon his illustrious descendants."

We thus learn that the Bridge of Harbeh is now six hundred and thirty-seven years old, notwithstanding the attempts to ruin it by the Arabs, which have failed of accomplishment; a moderate sum would render it again effective, but unless the canal were re-opened it would be an useless expenditure. As it is, it is the only high road across the Dijeil, and at the present time will admit the passage of twelve horsemen abreast,—a part of one arch only having been destroyed in attempts to cut off the communication with the desert portion of Mesopotamia, so as to prevent the Bedoins of the Aniza and Shammar tribes making their forays within the country protected by the stream. These irruptions, however, they now seldom try, unless in very large

* By this is meant the dwellers in towns, and the tribes of the desert who acknowledge the Mahomedan supremacy.

force, for of late the bridge has proved a treacherous path to them, owing to the tribes within, when the cry is raised of invasion, running to the bridge so as to cut off the retreat, which can be easily done, armed as they are with fire-arms, and having the dry cuts to entrench themselves in under the arches of the bridge, where the Bedoin horsemen cannot act with sword and lance, the only weapons in general use amongst them. The stream of the Dijeil, at present but three yards broad in its widest part, occupies but a very small portion of one of the arches of the bridge, its channel being cut in the bed of the ancient canal. Its attenuated and wire-drawn appearance, compared with the original conduit, is in fact a fitting emblem of the deterioration the fruitful country has undergone,—the gradual decay of which is pourtrayed step by step in the dry channels now existing in the original excavation, marking so many periods of its decline from the invasion of Hálakú, when the power of the Khalifs was crushed,* to the moment in which we are writing.

Our bivouac, in the bed of the Dijeil at Harbeh, was a delightful one, and as an examination of the bridge would occupy until noon of the next day, we pitched the tent on a grass-plat that conveniently

* The Dijeil was the scene of conflict between troops of the Khalif and the invading hordes under Hálakú, a chosen body of whom were despatched to make a diversion on Baghdad by the desert route through Mesopotamia. They were encountered by a detached force of 10,000 men, whom Mostassem B'illah had sent to intercept them, under two of his favorite generals in all likelihood on the desert side of this Bridge of Harbeh, perhaps, as now, the only practicable spot for invading the territory within the canal. A terrible battle ensued, but was attended with no favorable results to either side. In the night, however, the Tartars succeeded in cutting the dykes of a canal, and in overwhelming the Khalif's forces in a sea of water. Victory was thus made easy to the Tartars, who now overspread the country on the West side of the Tigris; while Hálakú himself, with the main body of the army, appeared before the gates of Baghdad, on the Eastern side. (D'Herbelot's Biblioth. Oriental.) The learned author has, however, inadvertently I believe, confounded the Euphrates with the Tigris in his notice of this engagement, for he infers the canal whose embankments were destroyed was a cut from the Euphrates. It is manifestly an error, and the canal alluded to, if not the Dijeil itself, I consider to be no other than the great Izhákí conduit, the most Northern and Western of all the canals that left the right bank of the Tigris, and consequently the first obstacle in the way of an invading army coming along that side of the river from the North. The error is by no means an uncommon one,—we find the Euphrates confounded with the Tigris by the ancient geographers, and indeed the present occupants of the banks of the stream in this part, more frequently term the river "El Frát" or Euphrates, than Al Dijleh, the proper Oriental appellation of the Tigris. What I conceive to be the orgin of this error will be found a few pages further on. دبيل Dijeil is the Arabic diminutive of Dijleh.

The present name Harbeh may have reference to the conflict, for حربة signifies "battle" in Arabic, and any event of this nature, of less import than the change of dynasty which happened in this case, is sufficient cause with the Arabs for the adoption of a new and a commemorative nomenclature. The name, as known at present, I have not been able to find in any geographical work, but am inclined to identify the spot as the position of Alkhátiréti of the Kitab-al-Akalim, from its being the site of the largest town between Al'Aith and 'Akbara, whose positions are known and indisputable. [See catalogue of towns on the Tigris extracted from the above work, mentioned in note page 27, and refer to the map for their relative situations. Appendix under the letter S. shows the bearings observed at Harbeh.]

offered itself alongside the running water in the canal. After the evening meal had been done justice to, a council was held on the route to be taken to-morrow; whether we should advance at once over the bridge boldly into the desert, in search of the Median Wall,—by pursuing a course that should cross its line, if, as represented, it should extend across Mesopotamia to the banks of Euphrates,—or pursue our journey onwards within the canal, in comparative security from the Bedoin tribes, to the camps of the Majummah beyond, and there address a letter to a Dellim chief, whom we knew was encamped opposite to Samara—requesting an escort from the tribe to conduct us to the Euphrates, as I had determined on tracing the wall to its termination wherever it should be. The difficulty opposed to the latter plan, after leaving the bridge, was crossing the Dijeil itself, which has deep and abrupt banks in the higher country, and quite impassable unless the Majummah would construct a temporary way across the gorge the stream is confined in. Danger of being met by Arab parties was the objection to the former plan, which however had been the mode settled as the one to be adopted some days beforehand, but as the solitude beyond the bridge now stared us in the face, the spirits of the party sank, and our guides openly expressed their fears of treading on the soil where the enemy of his species, having his "hand against every man," is the only acknowledged inhabitant. Though the skins were filled for the journey, it was idle attempting to overrule their objections, and we accordingly, on the following day (March 26th), pursued the route along the old bed of the Tigris—which is now abounding in cultivation to the North-westward. A mile beyond Harbeh the Nahr-Beled, the irrigant leading to the village of the name, leaves the Dijeil, and crossing the old valley of the Tigris where it is plentifully distributed, it conducts to the gardens of Beled, where it is finally expended. On the ridge forming the West boundary of the bed of the old Tigris several ancient canals are seen, which originally derived their waters from the river. Lower down they are cut through by the more recent Dijeil, but their continuities are distinguishable beyond, in the open country between it and the line of the ancient Izhákí. Opposite to these canals, on the left bank of the old course of the Tigris, some mounds are seen, probably of great antiquity, surmounted by a ruined town. These are known as Al 'Alth, another of the positions

enumerated in the course of the Tigris in the Kitab-al-Akalim. I did not visit it, as from a superficial view it offers nothing of interest whatever. The same may be said of the mounds of Jibbáreh, the site of other ancient ruins on the same side of the old course of the Tigris as the previously named town. These we reached in two hours from the bridge at Harbeh, * but not without difficulty from the steep banks of the irrigating cuts from the Dijeil, which we were compelled to ford owing to their having no bridges across them. Our camels, indeed, frequently fell in their attempts to climb them, and without being held up by the men would never have kept their footing. Half way between the ruins of Al'Alth and the mounds of Jibbáreh, a considerable canal leaves the Dijeil : it bears the name of Mastánsir, and is said to be the work of the same Khalif that erected the bridge at Harbeh. A little to the NW. of it the Al'Alth, another branch of the Dijeil that formerly led to the mounds of the name, is passed, but since the desertion of the place, the duct has ceased to be in operation. The courses of the Mastánsir and 'Alth canals are convincing proof of the old channel of the Tigris having been dry when they were excavated, for they lead directly across it.

On approaching Jibbàreh, the sons of the Majummah sheikh came out on horseback to welcome us to the camp pitched in the bed of the Tigris, and to our surprise we find their father, the individual to whom the Zábit of Sumeyeheh addressed the letter we have, is in prison in the village of Beled for a debt incurred by his having stood security for a family that subsequently fled. Luckily, however, as Englishmen, we are not unknown to the tribe, and keeping the Zabit's letter, which in the present state of affairs might have rendered them less civil-concealed, we encamp in their immediate vicinity, and are soon involved in considering complaints of oppression which are put to us to solve, and with which we have as much concern as that unknown but neutral functionary familiarly demominated "The man in the Moon." Not to listen, however, to our hosts—as in more polite circles where the infliction is equally bad—would be rude

* At this place Jibbareh, the ancient bed of Tigris and the margin of the present course of the stream, in high seasons, are blended in one great flat with ridges of shingle traversing it in many parts. The stream now occupies the East portion of this, having in its progress severed an arm (South of the Al-Kaim branch) of the great Kátul Canal, which again is seen entire a little to the East of modern Khán Mizrakji. The bearings here are in the Appendix under T.

and discourteous, and we therefore glean from the sons that the father is the same Ahmed-ath-Thâhir who was so cruelly shot, and deprived of both his eyes by some irregular troops of 'Alí Pasha, twenty years since; in fact, the same person so feelingly mentioned by the late Dr. Ross (*Jour. Geo. Soc.*,) in his journey to Al-Hadhr. Like ourselves, these worthies had sought the hospitality of the tribe for the night, but after being entertained had treated the women of the family with indignity, which was naturally enough resented by the chief. This interference so incensed a brutal soldier that he fired his gun into the temple of Ahmed-ath-Thahir, and from that day the venerable old sheikh has not seen "the light of the sun" as his children expressed it. He is now I am told nearly eighty years of age, and though blinded by the licentious fury of a Turk,—the Turkish agent has no consideration for his peculiar sufferings, his darkened state and the decrepitude of years—but for a sum equivalent to £2 10*s*. of English money, has incarcerated him in the dungeons of Beled. We lent a ready ear to the sad tale, and have promised to write to the Zabit in his behalf, having in fact good grounds for a friendly interference from the Zabit's recommendation of us by letter to a man whom we find in the custody of his agent, and therefore incapable of attending to his wishes. A despatch was accordingly sent to Sumeyeheh with a request that the blind sheikh might be freed from his bondage, the messenger being at the same time charged to pay the sum he is detained for, if his release could not be effected otherwise. In a few days we had the satisfaction of sending the order directing his emancipation from prison, received with a note full of unmeaning compliments and apologies, but not a hint on the subject of the debt;—we found, however, that our surmises on this head had not been far wrong, for the person sent to release the unfortunate sheikh was desired to acquaint the agent of the tender that had been made, with full authority for him to accept, but not to demand, the uttermost farthing, in return for the liberty that had been accorded. The hint to this effect on the part of the agent, with a show of extolling his master's liberality, was actually intended as an indirect plan of securing payment, which was accordingly made, and it now remains a question whether the sum is shown on the profit or loss side on the state accounts,—for with the latitude granted, and a knowledge of the character of these worthies

the Vakeel is doubtless enjoying what is looked upon by all understrappers as a God-send, in other terms an opening given whereby they can enrich themselves at the expense of both parties, and in this respect, so universal is the custom that but little shame is felt at such a proceeding. It is in fact another link of the great chain of corruption which surrounds all social relations, whether of state or otherwise in this country, and is passively submitted to by the masters,—for servants, as I have mentioned before, have either no salary at all, or it is so small that this has become a sanctioned system of reimbursement during a term of service.*

The Majummah were in raptures at the interest we took in the release of the old sheikh, attributing our motives to a personal regard for the tribe, which of course we did not deny—though we had more selfish reasons for conciliating their favor, irrespective of the sympathy the treatment of the blind patriarch called forth. In fact, the Dijeil was to be crossed on the morrow, and without their aid we could not effect it. After the messenger had been despatched, and the circulation of the coffee had tended to dispel the remembrance of their wrongs, we inquired after the "Chali," as the ridge which has hitherto been identified with the Median Wall of Xenophon is called. We are informed that it is close on the other side of the Dijeil, and all parties agree in saying that "it runs to the Euphrates across the Jezireh," or Mesopotamia. Here then one would think was evidence sufficiently conclusive, and accordingly a letter was despatched to Sheikh Hassan, a Dellim chief, for an escort to accompany us along its course. This tribe is encamped opposite Samara, having come from the bank of the Euphrates,—which they usually do in the Spring for the sake of rich pastures that, in this season, spontaneously shoot up on the high grounds here bordering the Tigris to the West. After much cross ques-

* The system has doubtless prevailed, more or less, from the earliest ages. The Scriptures indeed are not wanting in like instances of mal-appropriation, and the punishment of Gehazi for a similar deception on Naaman the leper is familiar to every one. Elisha, however, was a more scrupulous master than the modern Turk, whose hands are red with deeds such as Gehazi's, and it is a consciousness of this defect in himself that allows the master to connive at the acts of the servants throughout the East. Complaints made on this head answer no good purpose, for the judge, like the arbitrator in the fable, appropriates the "oyster" to himself by way of settling the dispute. I was once condemning the laxity of the law in this respect in an assembly of these people, when one of the knowing ones retorted by arguing that the speed with which decisions were arrived at in the East did away with the anxiety and expense attending law proceedings in England, where in the end, both parties were frequently ruined by the interminable delay on a matter that had originally been of but little value, if possessed by neither party. This was a rejoinder I little expected, and confess took me aback for the time, for in many cases it was but too true.

tioning it was, however, elicited that but few of the Majummah had been at its termination, owing to their never venturing for fear of plunder beyond a certain distance of the protecting Dijeil, and in a little time, by persevering in our queries, we found that but one old man had traced it, on a hunting excursion after antelopes as he said, to a distance of four hours from the spot we are in. As an answer could not be received from the Dellim until the evening of the next day, we determined on making a partial examination in the mean time. The tribe readily agreed to construct a bridge of wattles and earth across the Dijeil, and a couple of the Sheikh's sons volunteered to accompany us on our examination, though the old fellow stoutly refused at any price to be of the party, saying that he was too inactive to venture now on the Bedoin haunts, though he had laughed at their beards pretty well in by-gone times.

March 27.—Leaving the dromedaries and instruments with the more inactive animals, servants and tent, to proceed to the bridge at Harbeh, where I proposed returning by the desert route in the evening, we mounted, though personally suffering much pain, having incautiously reclined on a penknife which was placed open upon the carpet, and thus received the entire blade into the sinews under the knee-joint. Recrossing the Alth and Mastansir canals we skirted them to their junction with the Dijeil, the spot from which they emanate being exceedingly high and affording a good view around. * To the West there is no sign of habitation, nor a living being to be seen, but the works of man lay extended as far as the eye can embrace. The line of mounds running perfectly straight in a direction of 206° is pointed out as the Chali Batikh, and is the ridge that has hitherto been

* The Dijeil canal here takes a small curve to the East, sweeping round a high mound of earth, which I have little doubt marks the site of some position of antiquity. On it now stands a Mahomedan tomb, named, *Khathr Elyás*, one of the many of this name that have resting-places noted in the country. I have little hesitation in pronouncing this quadrangular mound as connected, perhaps in remote antiquity, in some way with the mounds of *Jibbareh* exactly facing it on the opposite side of the old bed of the Tigris.

Refer to Appendix under *u*. for the bearings taken on these elevated mounds which, anciently, were washed by the Tigris when it flowed in its old bed at their base. I shall again alluded to this spot in considering the position of the great dam across the Tigris.

The present name *Chali Batikh* is, in my opinion, a corruption for Chali Batikh. The first word I am unable to give a derivation of unless the rampart and ditch resemble the Persian چاڵی or hollow way made use of by weavers for placing their feet against when at work. It is evidently a Persian word;—the latter term Batikh with the ignorant Arabs has, doubtless, usurped the less known, but expressive word بطيح a name generally in use among Arabian authors for marshy and gravelly tracts of ground where waters collect from higher lands and to this place strictly applicable, as will be seen when describing it.

considered by modern geographers as the Median Wall; but its materials in no way answer to those of Xenophon's description in the *Anabasis*, being nothing more than a ramp or high dyke composed of a hard pebbly soil thrown up on one side (the South only) from the excavated trench at its base. Its NE. end was originally connected with the great mound on which the tomb stands mentioned in note (*) of the preceding page, but the Izhákí canal, in a later age, has severed the "dyke" from the great ruin, in its course to the SE.

The Izhákí itself of the ample dimensions of other ancient arteries runs parallel in this part with the modern Dijeil, just above the connexion of the rampart and canal; but while the Dijeil is led in a curve to the East of the ruin, the Izhaki, as straight as an arrow, here passes it to the West and traverses the country in a direction of 63°. The aliguments of a large town are also seen in rectangular lines of white mounds, now raised only a little above the level of the country, immediately to the right of the Chali. These mounds are termed Khayt-al-Abíad by the present occupants of the territory, from their white appearance. They embrace an area of considerable extent, one angle of the walls just touching upon the trench of the Chali Batikh. The appearance altogether points to the locality as being formerly a very populous one. Our party, as far as its knowledge extends, agree on its antiquity, referring the works to the days of Nimrúd, and in the desire to convey information—suggested partly by their own ideas, partly perhaps by erroneous and simple traditions not worth recording,—proclaim, in addition to a surprising ignorance, an absence of all interest in anything relating to the history or the common geography of the neighbourhood. As we scanned the country around, we heard them even confounding the great rivers themselves, by calling the stream flowing at their feet by the name of "Al-Frat," the distinctive title of the Euphrates—nor afterwards, when corrected on the subject, would they refer to it as the Dijleh or the Tigris, habit having confirmed them in the use of the term "El-Frat" though when argued with, they readily enough acknowledge their error. The source of this confusion is, however, easily seen, and is attributable to the annual visit of the Dellim and other tribes, whose territory is on the

* خيط ابيض Khayt Abiad "white lines."

Euphrates, bringing with them to the banks of the Tigris the cherished name of the stream that has flowed past their homes from childhood, and which feeling in the Arab, in his utter contempt for usages other than his own, cannot be eradicated. This great love of a familiar nomenclature in the Arab is, indeed, one of the obstacles that the comparative geographer has to overcome in his path to truth. * A patient investigation may elicit a great deal at times, but generally the changes and migrations of tribes have been so frequent and rapid in their succession, that the labyrinth before the inquirer cannot be pursued, owing to a disconnexion at the outset, the effect of ignorance, and a perfect disregard of such matter in the minds of a purely nomade people.

A precarious bridge that formed a catenary curve as the unmounted horses were run across it, was at last constructed, and the party stood on the other side of the Dijeil. There was evidently much reluctance to proceed, but going ahead the rest soon followed into the solitude. It was, however, remarked that instead of the song and laughter, the usual accompaniments of the march along the safer tracts, a dead silence prevailed while every one kept alert in the saddle with a stretched neck and a straining eye to catch the slightest object in the distant horizon. Not a pipe was lighted for sometime, until confidence had succeeded to the alarm at first felt; the march being conducted parallel to, and under the lee of, the mounds of the Chali Batikh so as to prevent observation from the higher lands to the North. In this way we sped along in silence and at a quick pace,—every now and then a keen old negro of the party, well used to these wilds, just ascending high enough on the ridge for his eyes to scan the prospect beyond. In a quarter of an hour from the Izhaki we reached the angle formed by the walls,† called the Khayt-al-Abiad. This touches the outer edge of the ditch on the North side of the Chali ridge, and without doubt

* This proneness to substitute patriotic and familiar names for the establi-hed appellations in vogue in a country existe l from the earliest times, and the system of transplant ng the human race from t e conquered provinces to foreign and rem te districts, tended further to alter the phraseology of proper names. Indeed it is only since geography has become a science, that the integrity of nomenclature as been preserved in its fullest sense and, even now, is liable to considerable distortion from the inattention of compositors and from bad copyists, notwithsta ding every precaution is taken to prevent it, by printing the proper names in the manuscripts, and by accentuating the vowels, so as to convey the proper pronunciation.

† The East wall appears to have extended as far as the Izhaki in a line of 340° while the south one ran in a direction of 239°.

enclosed, at a very early period, a large town: nothing but the lines of its walls marked in the soil remain; but these, worn down as they are, attest to its great age. Leaving this we maintained the same course of 206°, the ridge hitherto deemed the Median Wall bearing throughout the same aspect and character as at first, and from the uneasiness felt by the party it was thought, at one time, that the reports of its extending to the Euphrates were well founded. Determined, however, to persevere at all risks for three hours, before turning back, we continued onwards, and in fifty minutes from the Khayt-al-Abiad, the true character of the work was at once seen by an opening in the ridge or dyke, corresponding to a board, * a and shallow valley that, rising at the base of the undulations of the higher country to the North, traverses Mesopotamia in the direction of the low grounds to the SE. The ravines in the undulations above are all seen to lead into the head of this valley, which cut off from the lower portion by the Chali Batikh,† forms a basin-like reservoir, that when the rampart was perfect must have resembled a vast lake, at a time when the copious winter rains coming from the up-lands contributed to its supply.

In addition to the valley we have mentioned, it would appear from a canal on either side of the opening in the dyke, that any great body of water in the reservoir could be diverted on to the more elevated tracts adjoining, for a more extensive irrigation, while, during seasons of drought or any great pressure on the dams in the Tigris, a copious body of water might be led off by the trench of the Chali into the heart of the country to prevent a rupture of the great dykes that must have existed in the neighbourhood for diverting the stream into the Kâtûls, and which dykes I am inclined to think extended across the Tigris from the NE. end of the Sidd Nimrûd to the present mounds of Jibbâreh on the opposite bank of the old course of the river, but I shall recur to this subject again after an examination of a spot called Kanâtir in the vicinity.

Leaving the opening, another mile brought us to the termination of the ridge or dyke on the other side of the valley, distinctly marked by

* Appendix v.

† It is known also as the *Sidd Nimrûd*—"dyke of Nimrod," the other however, is the more general term, this latter being—though a very appropriate title—but seldom heard. The openings had gates in all probability fitted to them for regulating the supply of water when in operation.

having had a fort at its extremity for its protection; the walls and bastions at the angles being plainly perceptible on the slight elevation its ruin has formed. The whole bears evidence of a great antiquity, though the illusion that has hitherto existed of its being identical with the Median wall of Xenophon, or the rampart of Semiramis of Strabo, must now be dispelled, for neither in its construction nor extent will it in any way answer the description of the ancient writers, being in point of fact, a mere dyke, thrown up to a certain extent only for an express purpose, and discontinued when that purpose has been accomplished: at the same time, it remains an interesting proof of the great value set by the ancients upon water, which appears to have been collected from every available source, and as carefully distributed for the attainment of a more extended cultivation.*

* Though a regard for correct geographical ideas has made me overthrow previous received opinions in respect to the locality of the Median wall, I confess with regret that as yet I am unable to assign a new position to that structure. Xenophon's description of its materials "buried bricks laid in bitumen" is too clear to permit a dyke of pebbles and earth to be mistaken for it, while, at the same time the information he conveys of its dimensions and extent and its "not being far from Babylon" will scarcely admit us to doubt its existence at the time of Xenophon's visit, though not a vestige of it may remain at present. I am not quite sure however, but that a strict enquiry will reconcile the mass of Akrkúf as having, formed a portion of the wall in question—not only from its height and character, but in respect to its situation with the Saklawiyeh canal which latter with all deference and a wish to rescue ancient footsteps from the dust that has obscured them, I am inclined to recognise as the great trench "five fathom broad and three deep extending upwards as far as the wall of Media" "(Anabasis Book I.) for following the general course of the Euphrates, but not its windings which all armies must do. The itenerary of the marches made at leisure before the fatal battle of Cunaxa shews a distance of thirteen and a half parasangs performed between the Pylœ and the trench.—Now it will be seen on reference to our improved maps (Chesney's) that a place called Bukkah a little to the S. E. of the modern Hit will correspond with the Pylœ of the Greek author—not only in its character, but perhaps also in its name for Bekaa (بقاع)* as it should be written I think has reference to passes laying between abrupt cliffs and to deep ravines in regions varying from tertiary to alluvium, such as here conduct from the hard desert to the alluvial tracts of Babylonia and in this respect may be considered as the equivalent of the Ζυγη of the historian. Again, allowing the parasang of the Greeks to be of Eastern origin and as such as in name to correspond with the farsakh in use by the Arab geographers, a value of 5063 English yards has been found as its equivalent, from distances noted by them and subsequently measured accurately by myself. These give, in most instances 2½ Geo: miles exactly to the farsakh, and will here make a total of 34 miles; a distance which will be found to agree, as near as possible with the measurement between the places recorded as the "Pylœ" and the trench.

* The valley called Bekaa forming a pass the entire length of Syria between the Lebanon and the Anti-Lebanon ranges is an instance of the application of the term.

To enter into any further disquisition on the Median wall or the marches and counter marches of the "ten thousand" subsequent to the day of Cunaxa until a stricter search has been made would be absurd, but with our superior Geographical knowledge it is a duty we owe to the memory of the old writers to reconcile as far as possible any part of their statements with the truth. It is a work doubtless of great difficulty and labor, as the elaborate discussions of D'Anville, Rennell, Vincent and many others that have been given to the world testify to little purpose and as regards the positions of Xenophon subsequent to the defeat at Cunaxa could not be expected otherwise, suffering as the army was from privations and harrassed on all sides by a vigilant and treacherous enemy, in a difficult country where scarce a prospect remained of reaching their homes then at a distance of two thousand miles with

The previous identification of the Median wall with the Chálí Batìkh, is however, a natural enough error if grounded on information alone, and I confess to have labored under it myself for the last ten years though on the spot on a previous occasion. The Arab. with a wish to please exclaims "Meshwár" to the question of its length, extending his hand at the same time in the direction of its course and over a level desert such as this not having any determined position to fix his idea of extent upon nearer than the Euphrates, terminates it there when asked to define the meaning of the phrase, in the same manner as in speaking of events that have happened but recently, he uses the general term "Ams" literally meaning "yesterday." This has a sliding scale of application extending from last night over the twelve month that has previously elapsed, and in this respect, correspond in

respect to the Median wall—particularly other historians fail to take any notice of it unless the mere mention of a structure called the wall of Semiramis by Strabo on the authority of Eratosthenes (liber 2-143) be considered as identical with the Το Μηδίας καλουμενον κτιχος of the Anabasis. This we find twice noted by that geographer; once in reference to the course of the Tigris (liber XI. 151) and again when describing the distance between that river and the Euphrates Herodotus, however, who preceded Xenophon only by half a century devotes a considerable portion of his work to a detailed description of Babylonia and Media without, as far as I can see, mentioning the existence of a wall at all which had it divided Mesopotamia in two portions according to the ideas of all who have latterly written on the subject could not fail of being remarked by so minute a historian. It does not appear, however, that this author was so well acquainted with localities on the Tigris from his vague and unsatisfactory descriptions of the tributaries of that stream and the undefined position of Opis then we may presume the largest town on its banks. Herodotus in Clio CLXXXIX. Arrian the historian of Alexander the Great, not a century after Xenophon, is also silent with respect to the wall though Alexander in person navigated the Tigris from the sea to Opis: and I therefore conclude that instead of separating Mesopotamia in two portions the Median wall was a mere local barrier of defence running perhaps, in a North and South direction between the meeting canals drawn from the Euphrates and Tigris. I can indeed find no authority for the inference arrived at on this head by all modern writers and regard the wall in question as a protecting bulwark merely extending between the great trench or Saklawiyeh, and the banks of some of the canals drawn from the Tigris remarked by Xenophon—which ran down to meet the former in the direction of the modern named Izhákí and probably erected on the confines of the tertiary washings and the alluvial tracts to the S. E. as Akerkuf stands at present. It would thus have offered security to the towns, villages and cultivations occupying the intervening space between itself and the Tigris (of which the great city of Sitaki was perhaps the capital) from an invading force whose advance was always from a N. Westerly direction. That part of the country below the Saklawiyeh and the portion also East of the Izhaki to the North we may presume were sufficiently well protected by the canals themselves which unlike dead walls built across desert tracts, could support a large community for their defence established in forts erected along their margins. I yet hope to find some clue to its position in ruins named Deir and Sthr on the confines of the present marshes North of Akerkef and West of the Izaki canal. I conceive the "provision villages" and the district in which the "ten thousand" spent an anxious month of alternate hope and alarm occupied the triangular tract of alluvium now embraced by the angle formed between the Tigris, the Saklawiyeh—and the line of demarcation between the desert and cultivated soil. I never, indeed, understood thoroughly how modern geographers agreed to fix on so extensive a line as the distance is here between the Tigris and Euphrates for the position of the Median wall, particularly as the intermediate space is a tract of pure desert higher than the level of either river, incapable of being watered by canals and yielding nothing, that a force requiring to be kept on the spot for its defence could subsist upon. With a better consideration it must be apparent that walls traversing Mesopotamia would make but inferior defences when compared with deep canals such as we know existed and which indeed offered most serious obstacles to an invading enemy.

ambiguity with the "Meshwár" of distance which has any length from a horses walk backwards and forwards to a journey of a weeks' duration. From the conversation in the Majummah camp the error would have been continued had I not proceeded to the spot, and indeed so lax are they in speech that notwithstanding we stood upon the limit of the dyke which one and all had called "Chálf Batikh" for the previous twenty four hours, they had now managed in a distance of six miles to confound with the Izhaki canal, a traveller unacquainted with the language of the country and receiving his information through an interpreter, would be thus liable to endless deceptions, particularly when numbers, breadth and extent are conveyed by idiomatic phrases or metaphorical signs. Enquiry indeed, in this country is attended with much vexation and labor from the proneness of the Arab to exaggerate and falsify the little knowledge of locality which he really possesses, and the person who seeks for authentic information will do well therefore to trust in nothing but his own eyes.

We now turned to retrace our steps in the direction of the bridge of Harbeh, our guides first minutely examining a "trail" that had been under their scrutiny for the half hour we remained on the spot. Unseen by us it appears that four horsemen, having discerned our party in the distance had made all speed to get away before they could be overtaken. The Arabs declared the foot prints of the horses as not half an hour old and indeed, a little further on some fresh horse dung proved them to be right. From a closer inspection they even ventured to pronounce the fugitives as a party of Dellim, but I never could understand how they had arrived at the conclusion. It is certain however that in tracing they are very keen, and in this case every organ of the party was at work to assist perception in much the same way as an ore seeker would grub among the soils for traces of the metals he was in quest of. As we had come along we had evidence of the spot being a favorite winter locality of the Beduins spread over as the plain was with camel dung and the marks of their camp-fires under the lee of the Chabi the high mounds of which doubtless afford them a good shelter from the piercing N. W. winds. Progressing now on an E. N. E. course over the desolate plain, our party became more loquacious the nearer we approached the inhabited

district. In an hour's fast walk passing many herds of antelope, we came again on the banks of the fine old conduit the Izhaki which keeps onwards as far as the eye can see in the same unswerving line that has been noted before. Its dry bed has been a breadth of some 15 yards, with banks elevated much above the country.* On the East side, the line of the modern Ferhátiyeh, now also abandoned since the great plague of 1831, is seen to run parallel to the course of the ancient duct, whose breadth contrasts strongly with the attenuated, one yard wide, watercourse of the present day. Between the Izhàki, and the ancient course of the Tigris, a complete system of irrigation is seen to have been in force, for five other considerable canals, extending like radü from a bend of the old channel of the Tigris, above the ruins of Harbeh, carried the waters of the river over the intermediate space. In two hours from the end of the Chálí Batíkh, we had reached the bridge of Harbeh, near which in the spaces between the canals above mentioned, were several camps of the Majummah, whose inmates had not agreed with the Zabit of the Dijeil on the terms demanded by him for the possession of land within the territory of irrigation, and were therefore expelled the limits. These however, comparatively rich in flocks, and in the

* Appendix u. The Izhàki has the character of a first class canal, and though Abul-feda relates in a notice of Tekrit in the Taquimal Buldan, taken from Ibn S'ayed, that it was dug in the time of the Khalif Matawakkel, A. D. 850 by Izhak-ibn Ibrahim the chief of the Khalif's guard; we may presume that he repaired or re-opened it only; it subsequently taking his name, after the usage of Mahomedans, whose principal aim seems to have been the erasure of all records of the past, so as to refer every thing to the immediate era of their own times. At present even, the admission of water into an old duct by an opulent individual, is a sufficient cause for its baptism by the name of the party, which it retains until re-excavated by another. In Mahomedan countries, in fact, such a system of nomenclature points more to the era of decline than to the period of construction of public works, and the Izhaki may therefore be considered as but dragging out an existence ten centuries ago, for, had it been in operation at a more advanced period than we have mentioned, it would not have perhaps borne its present name, but the appellation of its last restorer, as these irrigants require periodical dredgings, which in canals of the extent of the Izhaki, could only be done by a Government, through a favorite minister, such as Izhakibn Ibrahim. Indeed we find in the same notice, on the authority of Ibn Hokul, who wrote in the tenth century, that the Dijeil as I have remarked in the description of that canal—then severed the Izhaki in two, and it further states that Izhaki was the most northern of all the canals, (derived from the right bank of the Tigris), which watered the territory of Irak-Abulfeda. It is therefore certain that it could not have been in Izhak's day, opened to its full extent, that is, from a little below Tekrit, and reaching to the neighbourhood of Akrkuf and Baghdad. The Kitabal-Akalim corroborates this in a measure, by describing the Izhaki as reaching only to Khatireti or Matiret, as it is variously spelt—on the old course of the Tigris, the exact situation of which (unless it be at Harbeh,—p. 26), I cannot define, but in the catalogue of towns in the same work, it is represented as standing next in order to Al'Alth, which position is identified in the present paper. Though I have not as yet traced the Izhaki along the whole of its course, I feel all but convinced that the Nâthrlyât canal p. 21—and Serakha duct p. 15, are emanations from it, if one, or the other, be not the trunk stream itself. The name in the Arabic is written Ishaki (Isaac) but I have placed a *z.* in lieu of *s.* before the deep *h.*, to render the pronunciation by the European less liable to error.

possession of fire arms, cared little for expulsion, being too independent to work, unless upon their own terms. They kept within a certain distance of the bridge for fear of surprize by the Bedoins, having their camps between the radiating canals, for a further security against horsemen, whose advance from a distance is duly signalized by scouts, constantly on the watch from the high embankments of the old conduits: our party created some alarm to them when afar off, but the smallness of numbers, distinguished as we approached, soon set them at ease.

The Majummah, as the name implies, are a large tribe congregated from minor families of Arabs, who are individually so small as to be unable to protect themselves, and parts of larger hordes who have originally migrated from a distance on account of feuds or oppression on the part of the Government. They lead both a pastoral and agricultural life, and are only so far nomade as to wander over the territory assigned them, which is the most northerly of the cultivated district bordering the Tigris and Dijeil. Parties of them are found in the Khâlis district, East of the Tigris, whither they have gone in search of employment; but by far the greater portion have their residence on the west of the stream, and extend from Sumeycheh to opposite Samara. They bear the character of most arrant and expert thieves, not in the Bedoin sense of the term, who, like the Borderers of old, "lift" whole droves of cattle at a time, and reckon "border theft and high treason" true gentlemanly accomplishments; but as petty larcenists that, like the shark in the wake of a ship, will follow caravans with a prying eye until they observe something worth purloining which they seldom fail in the end to secure—on these expeditions they are generally well known, and precautions are therefore taken when a Majummah is seen marching in company along the road. Not unfrequently they receive desperate wounds in following their favorite pursuits, and this evening, we have one of the principal men craving a remedy for deafness, and a singing in the left ear, which he says, is the effect of a blow on the head inflicted on him while sitting innocently down in a camp at Samara, by a native of that place. On enquiry we find his brother had been shot "flagrante delicto" while removing the contents of a saddle-bag from

a caravan at night, and this individual, from a sense of duty inculcated by the law of blood, notwithstanding his brother's crime, was at the time of the blow in search of the slayer, to take his life in return for that of the guilty dead. The party however, had received a hint of the design of our friend, and was before hand with him, by felling him with a heavy stick, that would have split any ordinary skull into pieces, as he sat on the ground, patiently awaiting the time for his purpose. The blow rendered him insensible for the moment, and paralytic for months after, but although he has not been able to meet the principal in the affair since, he quietly informs us that he has had partial satisfaction by the deliberate murder of two of his relatives. So vindictive indeed is this spirit of revenge, that this man openly avows his intention to continue the slaughter as he finds opportunity for, as he says, his "brother's blood is still crying unto him for vengeance" on the murderer, who, if lucky enough personally to escape the search which this worthy purposes to institute again in a few days, will have to lament the death of many of his tribe, before his offence—that of killing a highway robber, be expiated. Interested in the subject, we asked how many lives, in the event of his not meeting with his real enemy, would suffice to atone for the blood of his brother. He coolly responded—"Five, and as I have shot two, there remain but three more, whose days, Inshalleh! are numbered." Such a confession of premeditated and wholesale murder did not surprize us, knowing that the Arab at a distance from the capital, consults only his own passions, in the commission of any outrage of this nature, and even there, the price of blood is not confined to the strict law of "an eye for an eye, a tooth for a tooth, or a life for a life," owing to the apathy of the Government, and the influence of party. The Jew and the Christian indeed may be slain by the Mahomedan with comparative impunity, certainly at no risk that his own life shall be forfeit for the slaughter of one of his species, whose difference of creed alone, causes him to be ranked in the eyes of Islam, as but little better than carrion. With the tribes, however, the evil is not without its good, for "blood for blood" prevents the commission of murder in many cases, from a dread of the consequences involved in the act. After examining our friend's

head, we commended his resolution of proceeding again to Samara, adding that we had no better prescription for the cure of his malady, than a similar blow on the other side of the cranium, which he was likely enough to meet with there, and which, doubtless, would effectually prevent a return of the "singing" he complained of, by rendering him for ever unconscious of either feeling or sound. It was sometime before the drift of this was perceived, when a faint smile overspread his sullen features, and the miscreant took his leave, by no means pleased with the result of his visit. After his departure his own party condemned the blood-thirsty spirit he evinced, which is not indeed usual to the extent of this fellow's disposition; and a fear of being involved in his acts had already led most of them to pitch their habitations at a distance from his tent, which, I am told, seldom contains any other than his innocent wives and children; for he himself is constantly abroad—not so much on account of the vow he has made, as from dread of a similar fate awaiting himself, at the hands of the other party, only to be avoided as he supposes, by a constant change of locality. The brand of Cain is indeed, upon him, and marked as he is, he resembles a wild beast at bay, whose aim before he falls, is to perpetrate as much mischief as he can.

The night was just closing in, when the arrival of six horsemen was announced, and in a few minutes more—armed with sword and lance, they dismounted at our bivouac which was made in the same position as it was a few evenings before.—We found Hassan, the Dellim Sheik, whom we had addressed by letter from the Majummah camp, had dispatched his uncle, four brothers and his son on the instant, to do our bidding and to escort us wherever we thought fit to go. They were all fine looking men, and as usual with the Bedoin tribes had a natural air of independence and freedom which cannot even be assumed by the partially domesticated families who act as shepherd's out., or are employed for the cultivation of the soil. Though but poorly clad as most Bedoins are in the Zebùn* aaba and

* The zebun زبون is the outer garment worn within doors, the Aaba عبا is a mantle or cloak thrown loosely over the person when abroad, and the Kefiyeh كفيه is the name of the peculiar kerchief worn as a head dress by all Arabs, the marks upon which in many cases convey the name of the tribe and in this respect resemble the insignia worn in the head dress of the Scottish clans.

kefiyeh with a greasy sheepskin, worn like the hussar pelisse on one shoulder and the whole much the worse for wear. Their chief knew the position he was entitled to, and at once assumed it on the carpet beside me, first however performing the Bedoin salutation of laying cheek to cheek on either side the face, a ceremony I could well have dispensed with, redolent as his person was of an unwashed sojourn in Bedoin camps and heightened by the effluvium from the sheepskin which I was embrasing, and which, from its shining appearance had doubtless, performed the office of table napkin by day, while at night it had answered for a covering, perhaps, during a score of years. Mutual enquiries as to health having been gone through and his companions seated around on the ground, he informed us that Hassan the Chief Sheikh had desired them to accompany us across to the Euphrates, or to Eblis * if we had a mind to go there. This was a compliment which, however rude it would sound in English, meant nothing more than the party was entirely at our disposal. They informed us that the fugitives of the morning were a party of their own people who left them the night before in search of plunder. They had met each other on the road and described the numbers of our party with exactness though we had not seen them. It appears they had succeeded in capturing some five or six laden beasts belonging to the Bijeil district and hurried off to secure their prey beyond the reach of pursuit, which they imagined had already commenced when we hove in sight of them. Our new friends expressed some disappointment when told it was not our intention to proceed, as we had purposed—to the Euphrates, but the wound I had received in the leg from the accident of last night served appropriately as an excuse and not the having satisfied ourselves with regard to the extent of the Chali Batekh, with which they would have been but little pleased. The blood still on my clothes, satisfied them on the former head, but it subjected me to a five minutes commisseration from the whole party which fulsome and unmeaning as it was, could scarcely be submitted to with patience. It shews, however, the contrast in the Bedoin character, which, is a compound of dignity and obsequiousness; the former being the natural attribute of man in an independent position

* بليس One of the cognomens of the arch enemy of mankind.

who, confident of his power and proud of the lineage from whence he is sprung, cares not for privations or poverty as long as he is personally free, though he is cunning enough in his attempts at softening these hardships of his life, by every means that avarice can adopt. Where there is a prospect of advantage, by the exercise of the latter part of his character he will fawn and flatter at a rate sufficient to disgust before he has been five minutes in company, while, on the other hand, he displays his power, when thinking necessary to resort to it, in all manner of cruelties and oppressions. Yet he is, or was, not without his code of honor, in which the rights of hospitality and the sanctity of plighted word were esteemed, at one time, as sacred and inviolable. Now they are but as bye words in many tribes owing in most instances, to deceptions that have been practised on the Bedoins by the Turks whose great aim has been and is still—on account of their own weakness—to sow dissensions among them and to reduce the strength of the larger tribes by pitting family against family. The Dellim however are but a hybrid race and not strictly Bedoins, though a portion of them follow the Bedoin's usages and manners. They are reputed rich and possess both banks of the Euphrates from Hit to Felujeh, opposite Baghdad. In our conversation with these people the true extent of the Chali Batikh was explained as we found it; it would have been otherwise, there is but little doubt, had they not known we had traced it in the morning. We glean from them that there is a similar embankment and dyke further to the north, named Chali-Jalilad-Darb—somewhere opposite to Samara; but they all agree upon its limited extent, and we infer the excavation and embankment were executed for a like purpose. I have little doubt but the embankment and dyke of the Chali-Jelilad-Darb when visited will be found to correspond with the position in which, it may be presumed, the great dam for the northern arm of the Katul-al-Kesrawi was constructed across the Tigris, and in like manner as the embankment and dyke of the Chali Batikh relieved the pressure on the dams probably crossing the Tigris between it and Jilbareh, so also the Chali-Jelilad-Darb and its trench acted as a safety valve for the northern "bund" when extraordinary freshes threatened its stability. They remained as our guests during the night, and had every reason to be pleased with their entertainment for we were enabled to procure a sheep from the cultivators with which they were régaled and

doubtless enjoyed, as among themselves it is but seldom they taste animal food. The following morning we sent them rejoicing on their way to their tents with a new suit of apparel for the Sheikh and some articles of clothing for each of themselves, promising them an early visit on their own grounds, which, they assure us, abound in wrecks of former cities, over which they will be delighted to escort us.

March 28th.—We now bent our steps to the shoulder of land topped off as it were, by the change in the Tigris's course which situated as it was between the old channel of the river the Atkeim, as it formerly existed and the large intestinal stream the Katul-al-Kesráwí—contained many cities, and perhaps the position of Opis also. Modern geographers, either ignorant or forgetful of the great change the Tigris underwent, have insisted on identifying the ruins in the angle embraced by the arms of the Katul-al-Kesráwí with the vestiges of the lost Opis, but as the remains in question are evidently of a comparatively recent time, and moreover not in the position which we can fairly accord to Opis, we are compelled to seek for the site of this city in another place. Passing through the ruins of Harbeh, (where, by the bye we had further proof of a pre-Islam era in finding a much worn female face in terra cotta, having between the hair, which is high and curling, the curved horns of the bull, as represented in the sketch of devices accompanying the paper).* We crossed the old channel of the Tigris, and in an hour and seven minutes from the bridge of Harbeh came upon another place of the great labyrinth of canals that, previous to the irruption, emanated from the Kátúl, now on the other side of the river. A platform of brick, imbedded in the soil of a great age, points to the position of a bridge† across it and its direction would show that it was the arm that supported the town on the east bank of the old bed of the Tigris, just north of Tel'Aabar. Twenty-one minutes further on, in an E S E direction, after crossing the minor bed of the Shatayt, we stood upon a lofty mound of ruin, now termed Tel Dhàhab,‡ that was

* Marked *a*.

† See Appendix W.

‡ Tel تل is the common epithet for a "mound" Dháhab ذ ا هب "gold" Dháhab and Manjúr have occupied opposite angles formed by the junction of the Atkeim with the Tigris in the early ages. The old fortress of Tel Aabr seems to have been an outwork of the former Tel Hyr, would appear to have performed the same office for the larger city of Manjùr. See Appendix X for bearings at Tel Dháhab.

strewed in every direction around with bricks and vast quantities of pottery, marking the site of an old town (of which, perhaps, the mound was the citadel) that had derived its water apparently from one of the canals noted in page 39. Unlike the soil bounding the old channel of the Tigris to the West, the district here is a kind of friable marl without a blade of verdure, and bearing every appearance of having been frequently submerged. Quitting Tel Dháhab we cantered in the direction of a still loftier heap that appeared within a mile of us, being situate on the other side of a deep and broad indentation which we had to cross, and in the bottom of which we lost sight of the mounds altogether. To our surprise, too, instead of being a mile off as we had supposed, the party coming on at a walk were occupied an hour—so deceptive was the distance across the valley—in reaching Tel Manjùr, the name of this elevation, which is certainly the highest and most considerable mass in the whole country. Standing on its summit we had no difficulty in recognising the indentation* we had crossed as the continuity of the Atkeim in former ages, when the Tigris was confined in its old channel to the West, and, much interested in the subject, the determined positions† of surrounding tumuli in an examination made on this and the subsequent day, proved the whole to have formed at one time the continuous walls of a considerable town, that was of circular shape on three of its sides, and straight, as I judge, on the West face, or that running parallel with the indentation formerly occupied by the Atkeim. The character of these mounds (Manjúr particularly) differed from all others we had seen in our progress, for though much loftier than the rest, there was but little debris of material exposed, like in ruins of a comparatively recent date; the whole being buried under the accumulated dust of ages, which, indeed, is the characteristic of the older vestiges in all this country. The diameter of the city—one and a half geographical miles—whatever its name may have been, proves its extent, and in addition to its venerable appearance, we found strewed about the surface of the sur-

* Marked a a a on the map.

† I went to the whole of the mounds of Munjúr and took bearings for their individual positions from the summits of each. These are in the Appendix under Y.

Manjúr, its present Arabic name منجور signifies "fashioned" and perhaps traditionally implies the former beauty of, the place.

rounding country, fragments of saws and double edged knives or flints, perhaps neatly made from Agate,* the usual quantity of pottery and highly corroded coins in copper, besides on an adjoining mound, the erect naked figure of a female in terra cotta, with her arms close to her sides, and the hands, though broken off, distinguishable as having supported the breasts; the whole, however rude, being the image probably of the presiding goddess of the country whose statuettes are frequently found in all parts, fashioned both in marble and clay, and in this minor shape, perhaps formed the household deity of its people. †

Before claiming a position for the ancient Opis on the ruined site known as the modern Manjúr, it may be as well to take a retrospective glance at the records of historians and geographers of antiquity that in any way treat of it or its adjacent streams, so as to render the indentity as complete as possible, for since a better knowledge of the country has been obtained I have changed my opinion with regard to the royal conduit, the Kátúl-al-Kesráwí being a work of the Sassanian ages, ‡ and on subsequent reflection indentify the canal with Phuskus of Xenophon. § Of the works in my possession, or that I have had access to, Yákút is decidedly the most copious of the Mahomedan writers, and his M'ajm-al-Buldán, in speaking of the Kátúl, refers its excavation to the Kesráwí or "Cœsars" the distinctive appellation of the Sassanian kings of Persia; at the same time, however, he does not attribute the work to any particular monarch of that house, but gives the usual information employed by his sect—"the days of ignorance" as the period of construction,‖ which may bear reference to any era prior to Mahomedanism. It allows sufficient latitude, however, to give it consideration even as a design of a remoter age than the Sassanian and

* These are presented in the sketch sheet of the devices e e d d.

† The rude effigy here noticed is shewn in the sketch accompanying the paper under C., and the same figure excellently designed in marble found at Babylon, is seen under C. C.

‡ In a previous paper on the Katul's, the traditions of the country and notices of the Arab geographers Yakuti, made me decide the canal as a work of the Sassanians, from the Kesráwí being named as the monarchs of the period when it flourished. The term will however apply to an earlier Persian dynasty, and from other notices in history we may perhaps refer its excavation to the era of the Kaianian kings.

§ This I shall endeavour to explain hereafter.

‖ ايام الجاهلية Ayám-al-Jahiliyeh, "heathen darkness," lit: "days of ignorance," comprising the whole period between the creation, and the advent of Mahomed, when the *light* first dawned upon the Arab.

there is little doubt, but that the Kátúl-a'-Kesráwí really existed in a highly florishing condition, in the very early history of those kings under the name of Duras* —the Dura of scripture perhaps,† certainly the Dura‡ of Zosimus, and the Dural Hárith of Yákút,§ now abreviated to Dùr, the name of the modern village situate a little north of the spot where the canal emanates from the Tigris.‖ The historians of Julian's compaign¶ enumerate besides many towns on the line of retreat subsequent to the Roman army crossing the Tigris at Ctesiphon, of which Sumere, Dúras, and Symbri are yet recognizable—the first and last in Sámara and Zimbúr** of the present day, and Dúras is another title of the Kátúl owing to its source being at Dúr, the ruined position occupied by the modern village of the name alluded to above. So far we have positive evidence of identity and in the term Dúras, we cannot fail to trace the Terna of Theopanes and the Tornadotus of Pliny in connection with Major Rawlinson's exposition†† of the appellation Kàtúl and Kátúr, the names by which the conduit is imperfectly known to the ignorant people of the present day, but mentioned fully as the Kátúl-al-Keshráwí in the works of all Arab geographers.

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* Zosimus, Book III.

† Rich's Kurdistan and Nineveh, vol. III. chap XVIII. Daniel III., Kitto, however, deems the place without the province of Babylon and merely an idle supposition—Bib. Cyclop.

‡ Zosimus III. 89. The treaty of Jovian which wrested the Eastern province as far west as Nisibis was ignominiously concluded here after the death of the Emperor Julian. Dúra is mentioned by Polybius also a fortified place during the wars of Antiochus against the rebels of Media and Persia.

§ M'ajm-al-Bul-dàn-art Kátúl.

‖ Described in Journal Asiatic Society, Bengal, April, 1847. Its position has been well determined.

¶ Zosimus and Marcell Armenian. The ill fated Julian I have no doubt met his death on the banks of the Kàtùl-al-Kesràwl, in the vicinity of Sámara.

** At the place mentioned the Kàtúl has been cut through by the irruption of the Tigris Simbori or Zembár was overwhelmed in the catrastrophe that involved the whole country in one common ruin by the destruction of the great conduit. It was situated on the Kátúl, between the now ruined cities of Nai and Akbara, and to the N. W. of the modern village of Sindiyeh on the East bank of the Tigris as it at present flows.

†† Roy : Geo : Journ : vol : X. part I 93 and note* D' Herbelot notices the Kátúl when the khalif Matawakkel contemplated the building, or, as it should be, the restoration only, of Samara under the happy Mahomedan title of Serr-menrai, a facetious Arabicised form of its more ancient name. It would appear indeed that the titles of all the cities in this tract under whatever dynasty, had reference in some way to the pleasantness of the locality, for Qadesiyeh Sumere—Karkh-Garm Kirm, Kirman or Serrmerirai have, perhaps, an affinity in meaning. Th se were used when new works of any sort were projected, to the destruction, in most cases of the older names.

Prior to these more direct notices * of the great conduit, we have but collateral testimony of its existence and this I venture to draw from the "wears and other impediments," mentioned by Arrian as "placed by the Persians across the Tigris to hinder an enemy's fleet from invading them that way. † By Arrian and Strabo these impediments are placed at Opis and Selencia, ‡ up to which town, noticed

* Since the above was written I have found in Polybius, ib. V. cap. 5, that both Dura and the Katul al Kesrawi are mentioned in the wars of Antiochus the Great, against the rebels of Media almost under the same forms as they are noted in Mahomedan authors, and, indeed, as they are colloquially named by the better informed of the present day. In the history of the Seleucidæ in Syria, (Pubs. London, by Asborne in 1747 p. 210,) the country is minutely described between the Lycus, the modern Zab and the "King's Ditch"—the Katul, as unfit for the marching of troops while the latter is pointed out in the speech of Geuxus as an atestade to success in the event of the *Ditch* being possessed dy the enemy.

In itself this passage of Polybius will confirm the existence of the Katul al Kesrawi in connection with Dura so far back as the third century before the Christian era, and the aspect of the country *north* of this great conduit will be found from my own description, a few pages further on, to be in all respects unchanged; for it is naturally a desert tract in all ages as noticed by Xenophon from the time the Greeks crossed the Phiskus to their arrival at the villages of Parysatis near the Zab. Heraclius's campaigns will also bear witness to the difficulties of the country and the nature of the excavation; the "Royal Ditch" opposing great obstacles to the advance of an enemy. The disasters of Julian's retreat are all perhaps referable to the same cause, for immediately his forces crossed the Duras, the desert was entered, and the enemy possessed of the canal continued to harass them whenever they approached its banks for water which the troops were necessitated to do, for beyond was a parched up waste. On the banks of the conduit, Julian met his death, and at Dur his successor Sovian signed away the frontier fortress of Rome to the Persian Monarch.—See Arniman Marcell, Zosimus, and others.

† Arrian, Book VII., Chapter 7.

‡ Strabo, Book XVI. Chap I. Opis when Strabo wrote, appears to have declined in a great measure, to be succeeded by the city Antiochia, found by Antiochus Soter, the son of Seleucus Nicator, for he mentions it as a mere village, evidently decaying in the presence of the rival city, or cities rather, of the Seleucidæ, which were then increasing on the Tigris and subsequently known as the Beth Selùki in the Syrian record. Pliny in his 6th Book, Chap. 17, notices Antiochia which if not actually Opis under a new name, may, perhaps, coincide with the position occupied by Tel Dhahab, the remains of an extensive town contiguous to the mounds of Manjur, and resembling that ancient city in having, as I have mentioned in describing it, an out work at Tel-Aabar on the bank of the ancient Tigris similar to that at Tel Hyr which, to all appearance, was connected with Opis or Manjur. After describing Sitaki, Pliny says, "Ab occasu autem Antiochia (eadem Appolonia Ptolemœi) inter duo flumina Tigrin et Tornadotum." Here it's position is noticed distinctly between the Tigris and the canal and it appears to me that he is equally clear on the position of Apamia, a contemporary town erected by the same monarch now represented, as I imagine, by the modern name Qàdeslyeh—I quote his own words, "Item Apamia, cui nomen Antiochus matris suæ imposuit, Tigris circumfunditur. Hœc dividitur Arehoo"

Considering the context, this specifies the position of Aparnia as also between the Tigris and the Katul-al-Kesrawi, and environed as it were by the river; the Archous dividing or passing through the town itself.—The position of Qadesiyeh answers to the description exactly by the Alkaim branch of the Kátúl cut from the Tigris a little to the Mod. passing immediately north of the city, while the Tigris itself, sweeping round the steep promontory, is within a half mile of its walls to the south. A branch of the great Kátúl at the same time passing the walls to the west, threw off a duct which led through the ramparts into the heart of the enclosed town, verifying the writers description of the Archous, and the place in general in every particular. It affords, indeed, almost conclusive proof of the identity of the Ternadotus with the Kátúl-al-Kesrawi, and Qadeslyeh with the Apamia of the Seleucidæ. A full description of Kádesiyeh will be found in the pages of Beng[illegible]t: Soc: Journ: for April 1847, where I have detailed the canals and the dimensions of the town. The Nahrwan there mentioned is a modern but erroneous name in use, for the K[illegible]l al Kesrawi of the books. I was so much struck with its appearance and locality as to give a large sketch of the spot with the paper alluded to, which has not appeared for reasons I am ignorant of. The late Dr. Ross, however, has made a rough plan of the place accompanying his journal to Opis,

as the emporiums of the surrounding country, the Tigris is represented as navigable only, which, on a little consideration, is strictly true, though the causes for the stoppage of a further upward progress of vessels from the sea has been misrepresented either wilfully or through ignorance. This is self-evident, for the Tigris at the present day, though the artificial impediments no longer exist, is still as unfavorable to navigation beyond the site assigned to Opis from natural causes alone; for between Manjur and Qádesiyeh the geological features of the country change from a hard sandstone region of some elevation, at once into depressed alluvial plains; the descent from one to the other being so steep, as to occasion a leader like succession of rapids, down which the current pours at such an accelerated pace, as nearly to stop a steam vessel's progress; while in the vicinity of Manjur the same vessel's rate against the stream would be three to four miles per hour.*—During eight months of the year the rocky ridge

(vol. XI part 2d page 128, in the pages of the Roy: Geo: Soc: Journ:) which though minute, sufficiently well represents the features around. Since I became better acquainted with the vestiges in this country, I am enabled to pronounce Qadesiyeh, from the construction and materials of its walls, as a post Babylonian city, and by this expression I mean the period succeeding the Babylonian decline, the Macedonian conquest, and the rise of the Parthian power. I have before described the difference between the structures of this time and those of a Babylonian era (Narrative of Journey on Survey of the Kátúl and Nahrwan-art Mismat). In the former the absence of reeds between the layers of brick is the only peculiarity, and Qádesiyeh is wanting in this respect also. The Arabs ascribe its erection to Dekiánús (Decianus), according to my late friend Dr Ross. The statue found there mentioned by him and now in the possession of General Taylor, is also corroborative of its era and pagan origin. Mahomedan writers (Abulfeda partie) describe it as famous for the manufacture of various kinds of glass. Great quantities are certainly found there. Its present name Abúlfeda says was accorded to it because its inhabitants were deemed peculiarly sanctified in a Mahomedan age. The term قدس from whence it is derived, certainly means "pure" and "holy," but Qádesiyeh in reference to places also implies "a paradise" or "pleasant spot." Cadiz in Spain is an example from the same root, a name given to the spot by the Arab conquerors of the west. With some confidence, I shall now restore its name of Apamia on the map.

In Rich's time, it appears from his description of a visit to Qádesiyeh (Kurdistan and Nineveh) that the spot where the image was found had the name of Nebga and the Kátúl bore also the name of Ersas. The former may perhaps be referable to Nebo the special divinity of Babylonia so often mentioned in scripture, and in the latter we may probably trace the Archous of Pliny.

* My journey upwards in April, 1846, proved this. The following are extracted from the Bengal: Asiatic Society's Journal, April, 1847, relative to the subject. "The stream is now becoming more rapid from the increased declivity of its shingly bed as we approach the neighbourhood of Khan Dholölyeh; our progress, therefore, is proportionally slow" (page 306)—"At 5h. 45m. came to for the night, in exactly the same spot we spent the night on three years ago. Qadesiyeh then bore W. N. W. to N. N. W. Again I was not sorry when the declining rays of the sun obliged us to stop, for I felt much fatigued having been on my legs the whole day: indeed nothing but the greatest perseverance and attention to the steerage of a steam vessel through such intricate navigation as we have had to day could insure her making any progress. The bed of the river is full of islands and shingle flats, and as there is in this season of the year, but one channel of sufficient depth which receives the whole stream, it occasions, where it is thus confined, a considerable fall or rapid; some of which, notwith-

that crosses the bed of the Tigris is so shallow as to afford no depth for laden vessels, even could they oppose the current. Tacking, too, is impracticable out of the limits of the alluvium, owing to the shingle flats that extend from the shore, to a great distance in the harder tracts, preventing a communication by means of ropes with the vessel; nor, indeed, will the great height of the cliffs bounding the valley of the Tigris, in this part, permit of it. The navigation beyond Manjur is therefore never resorted to at the present day, and certainly never could have been without the aid of great steam power.

The erection of the dams or wears by the Persians must then have been for some other object, and not as a barrier as Arrian says, to the advance of an enemy. The locality, while it admitted the sea-going vessels up to the very verge of the rocky tract, and this offered an eligible spot; for the mart of Opis, was advantageous also in a Geological view to the erection of dams across the bed of the river, for retaining the Tigris at a high level throughout the year to supply the great artificial streams, the empty beds of which now traverse the province on either side to a great extent, that of the Kâtul-al-Kesràwi holding a course of 250 miles exclusive of its lateral derivatives. In the plain bordering on the Persian rivers we can trace similar canals drawn from the main streams, step by step, as it were, on their descent to the alluvial districts; and at Hawiza on the Kerkha, at Ahwaz, and Shuster on the Kuran, we find raised embankments or dams of surprising magnitude and construction across the beds of the rivers, in the same way as they are said to exist at a spot called Kanàtir, a little East of Qâdesíyeh on the Tigris; certainly the most eligible spot for such works, owing to the confined space of the valley of the Tigris, and the height and hardness of the cliffs on either hand, with which their ends were doubtless connected. Though I have not as yet examined these, from passing the spot in spring rises of the stream, I have per-

standing a heavy S. E. wind set in, enabling us to set sail, we could scarcely surmount." (p. 307.)

"From Khan Dholöíyeh the bottom has changed to a hard shingle, over which the current runs by trial, at the rate of 6½ geo: miles per hour." p. 307.

Considering the above, the removal of the dams by Alexander, to render the Tigris more navigable will be considered I think a work of supererogation, for I am convinced that neither Nearchus nor Onesecritus, bold as they were, could have shewn a stem against the torrent that here sweeps down between the cliffs.

sonally observed the strong ripplings occasioned by their presence underneath, extending in a broken but straight line of foaming water, and with some confidence view these masses of masonry as the remains of the "wears and impediments" said by Arrian to have been destroyed by Alexander the Great, as they offered obstacles to the navigation. There can be little doubt, however, but these dams were really designed for the exclusive service of the canal which opens at Dur and Alkaim, on the East of the Tigris; the former mouth being twenty-five miles, the latter but four above the site of Kanatir, which term signifies "the bridges," a name* in general use for ruined works of this description among the ignorant Arabs now residing in this vicinity.

Arrian's misconception of these works cannot, however, be passed over in silence, for with the laudable motive of extolling the deeds and valour of the Macedonian hero, he should not, without enquiry, have recorded him guilty of acts that savour little of the high minded policy which generally distinguished the conquests of Alexander the Great, or of his expressed wishes for the improvement of the acquired territories, the revenues of which in this part were enormous, and principally attributable to the complete system of irrigation established by the Persians. The destruction of massive works in the rivers such as the Tigris cannot be remedied in a day, and such an act as Alexander's must have immediately involved whole districts in one common ruin by withdrawing from the towns on the canals the element not only necessary to the subsistence of their population, but also required for the irrigation of the adjoining country. Besides, the demolition of such dykes instead of rendering the Tigris more navigable, would have the contrary effect of exposing the river upwards from the sea to a current of double velocity, in addition to many other evils which will readily suggest themselves, by a restrained river being suddenly let loose into its old channel that had, perhaps, been but partially occupied only for years before. The dams, indeed, made the upward navigation more easy by checking the stream, and I have shewn before that beyond Opis, or Manjúr, in the absence of artificial impediments, the river was not adapted for

* The "Gunterah" of Lynch's excellent map, the singular is thus pronounced Ganátir, or properly Kanatir, being the plural form of the word. I intend visiting this spot in boats when the river is low at the begining of October next.—Vide Supplement.

vessels at any time. The Persians had, therefore, no need to erect such works for defensive purposes, but having designed them for hydraulic requirements, it is easily imagined they made use of them when hard pressed by an invading enemy, according to the invariable custom they had of laying waste the territory on their retreat, especially necessary, perhaps, before a victorious army such as Alexander led. The destruction of the dams, however, while it might do injury to the Macedonian fleet, certainly redounded to the glory of the conqueror by inflicting calamity on the country, and in this light, perhaps, Arrian has recorded it in an off-hand style, attributing the erection of the works to a wrong motive, it may be from his own ignorance of their nature; but if it really happened as described, we must rank the act as barbarous as it was misconceived on the part of Alexander, and probably perpetrated during an orgie such as that which consigned Persipolis to the flames.

In my former narrative of the survey of Kâtúl, I have expressed a doubt as to the existence of dams across the Tigris, but since an extended examination of the derivatives from it has been made, I have become more impressed with its great magnitude, and now believe that either arm of it must have had its respective dam. Considering also the evidence of Arrian with reference to these works, I have little hesitation in according to this *great intestinal conduit* an antiquity coeval with the Macedonian conquest of the East from the destruction of the impediments by Alexander. The subsequent recognition of the canal as the Tornadotus of Pliny, not only in name but in the ruined Apamia of Antiochus Soter still on its banks, places it in a highly flourishing condition in the time of the Seleucidæ, and we may infer, also, that it was equally prosperous and rich under the Persian rule prior to the Macedonian invasion, or Alexander would not have led his troops to the conquest of a barren soil. Premising this in the Italic words above, the classic reader may, perhaps, without much ingenuity, recognize the Kâtúl-al-Kesráwí in the Phuskus* of Xenophon's

* I have adopted this orthography of the name of the stream recorded by Xenophon from Dr. Vincent's paper on the site of Opis (Vide "Commerce of the Ancients," vol. i. p. 534) for I have not the Greek original, nor can I find the term written any where in the Greek character. Spelman's translation gives Physcus as the English equivalent, and this orthography may have hitherto confused rather than cleared the "quæstis vexata" of its identity. Phuskus appears to me an appropriate name enough for such an internal conduit as traceable in some way through Φύοχγ or Φυοχος, both derivates I think of the word Φυω in the Greek language. I leave the decision, however, to the learned. The clever and laborious paper on Opis by the late

Anabasis, though the recognition may be of little extra value. Between it and the Tigris, then occupying its old bed contiguous to Harbeh and 'Akbárá, there lay a valuable tract of country, covered as with a net by the vinous branches that emanated from the great artery, which, wide rapid, and deep, was its defensive bulwark also from without in time of war.* Of such magnitude was the design, that rivers—the Atheim and the Díyáleh—were absorbed in the canal itself;† the former even being entirely arrested in the hills to allow of the broad and deep valley it occupied here besecting the province being filled up, so as to carry the canal above the face of the adjoining country.‡ A conduit dispensing such copious draughts, and also impassable by an enemy except at the bridges, must have been eminently navigable in itself, and distant from the Tigris, as it flowed in the early ages, but nine miles, which tract, by a glance at the map, will be seen was crossed by its ducts also, offered the most eligible situation for a mart such as Opis is represented to have been. The elevated rocky ridge crossing the country here would not permit vessels, as has been shewn, to proceed to a closer proximity with the canal, neither could the canal, to reap the full benefit of the elevated soil, be cut so as to approach nearer to the Tigris by a single mile, where nature has placed the insuperable bar to further navigation, without sacrificing advantages the artificial stream was especially designed for. The position of Manjúr, which I

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erudite Dean of Westminster is of little use, owing to ignorance of locality at the period it was written, and the same may be said of those parts of Rennell's "Expedition of Cyrus," that treat of this subject, from the like cause. It is to be regretted, indeed, by the lovers of geographical science that these two able men could not possibly have visited every locality they have attempted to unravel, for the masterly style in which they have handled the weapons they were provided with, could not then fail of yielding great results. D'Anvélle, too, has ardnously endeavoured to rescue the early foot-steps of our race from the mist that has hidden them, but his materials unfortunately were less clear than those of his successors; and, indeed, in attempting to identify the Tornadotus of Pliny he has, in some measure, led his followers astray, through the mis-caught sound of the Arab name 'Alheirn by the unpractised ear of the quaint old Tavernier, who has marked it in his second voyage as the *Odoine* of Chaldea. Book ii. chap. vii. 83. And speaking of Tavernier,—I may notice another error which is not of so innocent a nature, for in describing a dam across the Tigris in page 82 of the English translation of the same book, he states it to be 20 *fathoms* steep. Either this is an egregious error of the translator, or an egregious exaggeration in the writer, though the spot he alludes to is sufficiently alarming in the descent upon rafts. The tradition he appends to it is, however, corroborative of the existence of such works in the times of the Kaianian Monarchs of Persia. By subsequent reference to the French original I find it is an error of translation.

* See Heraclins' Campaigns. He abandoned his designs upon Ctesiphon from inability to cross the Arba or Narban, the Nahrwán of the country, and the name of that portion of the Kátúl-el-Kesráwí below the Díyáleh river.—Vide "Narrative of Survey of Nahrwan," 1847.

† The first in the Arab name of the stream that has been so long confounded with the Physkus. The last is the Gyndes of antiquity (Herod.), and the Tamerra and Melwan of the Arab geographers.

‡ "Bandi Atheim."—See "Narrative of Survey of Kátúl and Nahrwan, 1849."

claim for the site of the ancient Opis, occupies an exact central position between the dry beds of the artificial and natural streams, whether these be referred to as the Kátúl-al-Keshráwí and Shatayt of the moderns, the Tigris and Tornadotus of Pliny, or under the still older forms of Phuskus and Tigris of Xenophon, Manjúr has at present a diameter of two miles, and, from its peculiar position, may fairly be considered as identical with that accorded to the great central entrepôt of Opis, Tel Hyr of the map being, as I imagine, its outwork on the river; while the whole space between, as evidenced in the present remains, formed the suburbs of the vast mart and the residence of its traders. The ducts, marked on the map, now severed from the Kátúl by the irruption of the Tigris, once radiated around Opis in every direction, and not only irrigated its gardens and cultivations, but afforded a means of conveyance for the produce of the country from the inland towns to the emporium of the district; while, at the same time, the imports from the sea, landed at Tel Hyr, when Opis was the mart, and at Tel 'Áabar, perhaps, when Antiochia superseded it, were returned by many of these aqueducts to the great conduit itself, the numerous towns and villages of which had immediate communication with the caravan routes leading to Assyria, Armenia, and Persia.*

So far we have had only historical and descriptive geography to contend with, but the metrical geography of the Anabasis is worthy of much consideration; while, at the same time, I confess an inability to apply the distances quoted by Xenophon in determining the *exact* site of Opis, though the route of the "ten thousand" is sufficiently corroborative of the position I wish to assign to it at Manjúr, to prevent any material objections being offered, especially when we reflect on the distressed position of the Greeks and the difficulty opposed, in marching through a canal country, to the correct keeping of the itinerary of the day's performance, where innumerable streams from the Phuskus or Kátúl had to be crossed by small bridges. It will be best, therefore, to assume at once that the twenty parasangs recorded by Xenophon† as the distance between Sitakí, allowed to occupy a near

* Strabo, p. 1075, and Heeren in his Ancient Hist. vol. ii. chap. ii. page 234, notice the commerce. The latter, though not quite correct in detail, may be read with great advantage.

† Xenophon Anabasis ii. 34.

positon to the present bridge of boats at Baghdad, and Opis represented by the mounds of Manjúr, are correct, for their equivalent, or fifty geographical miles, exceeds by ten miles only the distance between the places as the crow flies,* and Xenophon no where tells us that in this part of the journey the nearest route to Opis by the Tigris, supposing it could be done direct, was followed on the march. On the contrary, the Anabasis is silent with regard to the Tigris until Opis is reached, and I am led to infer from this that the march was conducted adjacent to the Kátúl or Phuskus, as the lower country bordering on the Tigris must have been covered with fields and numerous irrigants, which all pour that way, as at present, from the Khális, and were, consequently, impassable by an army.† It was, moreover, suspected that the Persians wished to keep them from strengthening their position in the event of their determination to settle and abide events, and, therefore, we may conclude they were conducted by the more open road along the higher soil at a distance from the Tigris until the bridge of the Phuskus, where the enemy awaited them, was crossed, and the anxiety of the Persians thus relieved; they were then enabled to concert those projects which they put into execution so treacherously at the Záb. The excess of route over direct distance is, therefore, fairly chargeable, under the circumstances of the retreat, to the irregularities of roads, without any allowance on the score of error in the dead reckoning, which, on the more lengthened march from Opis to Cœnœ, must have been considerable, harassed as they were after passing the Phuskus by the attendance of a vigilant enemy. Discarding his distances, however, beyond this point, there are in the Anabasis, and in other ancient writers, local evidences of importance for ascertaining the approximate position of Opis which are not so liable to dispute, inferred from Xenophon placing this "large and populous town" on the Phuskus while other writers

* See note * at page 90.—I have remarked before that the farsakh of the Arab geographers, which I have compared with my own measurements, give an exact quantity of two and a half geographical miles to the farsakh; for instance 'Akbará is given by Abul-feda, in the Taquim al Baldan, as ten farsakhs from Baghdad; on this journey by my work it is 25 geographical miles from outside to outside of the cities in direct distance. This makes the equivalent of the farsakh 5,062 English yards.

† The road to the North at present leads to the East at a distance from the Tigris.

are as decided as to its position on the Tigris.* In number these latter place Xenophon in a minority, but from his general perspicuity, we may, perhaps, be permitted to give him equal credence, and to fix the site of Opis between the two streams, the Phuskus and the Tigris; particularly as the Greeks may have filed over the bridge of the Phuskus, or Kátúl-al-Kesráwí without, perhaps, remarking the Tigris, which was really at a distance of six or seven miles, if they came, as I have specified above, by the more elevated tract less overspread by cultivation. By giving it this exact central position between the diverging streams at the hard rocky barrier opposed by nature to a further ascent of the Tigris, we do not offer violence to the narrative of any writer of antiquity that I know of; but on the contrary, if the Antiochia of Pliny be "in situ Opis" as may be inferred from Strabo, we have positive grounds for fixing the place or places according, whether they be identical or contiguous cities, both at Manjúr in the former case, though, in the latter Manjúr will represent Opis alone; Antiochia must then be recognised in the adjacent mounds of Tel Dhohab, it being, as Manjúr also is, "inter duo flumina Tigrin et Tornadotum" according to Pliny, or "between both streams."

I have but one more remark to offer on the subject of the Phuskus and its full identity with the Kátúl-al-Kesráwí, and that is the breadth of "one hundred *feet*" given by Xenophon to the stream which, he adds, had a bridge over it.† The former may be deemed an objection considering the Kátúl has a width of one hundred and thirty "*yards*." In the first place, we may fairly presume that no actual measurement took place, watched as the Greeks were by the Persian army, and if so, every one is aware of the errors that can be made in surmises of this nature, setting aside the ever varying widths of artificial streams, which, in addition to being regulated at will by a succession of dams

* Of those who place Opis on the Tigris first, Herod. book i. Clio. clxxxix., Arrian chap. vii., Cellari, vol. ii. page 462, has, in hoc chaldæorum tractu fit. Opis, emporium ad-Tigrim; lastly Strabo. xvi. 151 and xvi. 171, where he says, "By the Tigris you ascend to Opis and Selencia." This last must not be confounded with the first Selencia opposite Ctesiphon; but is the Antiochia of the son of Selencus Nicator, who was the founder of the former city as well as of the dynasty of his name. The Beth-Seluki of the Syrian M.S.S. is identical, perhaps, with these towns of Antiochus. Soter Xenophon is the only writer, I believe, that places Opis in any other position than on the Tigris. He fixes it on the Phuskus without reference to the Tigris at all. Anabasis ii. 34. Pliny, though not mentioning it by name, places it distinctly between both the Tigris and Tornadotus. Book vi 334.

† Anabasis ii. 34.

and sluices in their course, such as this has, are increased or diminished in drought by copious falls of rain led into them from the uplands, and by the fluctuations in the trunk from whence they derive their supply. The passage of the Greeks was effected, too, at the latter end of autumn, when all streams are at a minimum, and likely enough the Phuskus at the time of the record was but a fourth of its maximum size. The bridge, however, is not wanting in the Kátúl, for it exists still in the soil of its bed at the foot of a high mound called Tel Mahassil*, not six miles from the site of Opis at Manjúr. The fact, too, of the "ten thousand" Greeks at once emerging from this spot into the desert part of Media," is another link in the chain of evidence†, for I have described the Kátúl-al-Kesráwí, or the Phuskus, in the narrative of its survey, as the line of demarcation between fertility and desolation, the protected alluvium tract between the Tigris and the great canal having been, as exemplified in its ruined towns, villages, and dry water channels, a paradise for man in the oriental acceptation of the term; while, all beyond being an elevated ridge of pebbles out of reach of irrigation by canals, was ever as it is now, an inhospitable waste, devoid of either water or vegetation. I have crossed this wilderness and not a vestige is seen or heard of, that could mark it as the former abode of our species.

I have now done with the geographical considerations of Opis, but am by no means assured that my remarks will be understood, though I have spared no pains either in the local search or in records at hand to elucidate its position. Herodotus, vague and unsatisfactory as his notices of the Tigris are, merely mentions it by name as a town on its banks,‡ while Diodorus Siculus is mute altogether regarding it, though eloquent on the scene that took place there.§ From Herodotus, however, we glean that Opis was the name of one of the Hyperborean virgins whom the inhabitants of Delos honored with divine rites and sacrifices. She was generally regarded as the daughter of Diana,

* See Dr. Ross paper on Journey to Opis, Roy. Geo. Soc. Journ. vol. xi. pp. 11. 24, and my narrative of "Survey of Kátúl," 1849. The foundations and piers are distinct in the bed of the canal denominated erroneously "al Kabbúr," by the modern Arabs.

† Anabasis ii. p. 35.

‡ Herod. in Clio clxxxix.

§ Diod. Sicul. book xvii. chap. x. 2.

herself worshipped at one time nearly over all the East, and, according to Servius, was considered in the mythology as synonymous with Luna.* In the fifth century before Christ, the Persian wars with Greece, under the generals of Darius Hystaspes, though vigorously conducted, did not end with the anticipated success, but it is not improbable that this intercourse with the Greeks, particularly with the isles of the Mediterranean, impressed the early Persians with devotional ideas in the absence of any strict religious system of their own. On their return from these expeditions, and during intervals of peace, when trade and familiar intercourse had succeeded to the former enmity, it is not unlikely they founded the mart on the banks of the Tigris for the convenience of surrounding nations, dedicating it, at the same time, to the worship of Opis, by instituting the religious forms in vogue at Delos ; from whence, indeed, they may have transported the image of the frigid virgin of the North. We have the authority of Herodotus for saying that no nation in the world was so ready as the Persian to adopt foreign customs,† and the celebrated Datis, himself a Mede and a conqueror, confirms the thruth of the statement in his address to the inhabitants of Delos by publicly venerating their idols, and in offering incense on the altars of Diana and Apollo.‡ Like many other cities of Persia, Opis, perhaps, contained a portion of the captives of the Grecian wars, from the prevailing customs of transplanting the vanquished,§ either to colonize new cities, or to serve as mercenaries in the ranks of the army, where their discipline tended to the impovement of the irregular hordes of Persia, and materially aided, not only in the subjugation of new states, but in the consolidation of the empire also ; for they assisted the monarch in quelling disorders amongst his own subjects, which we are told were prevalent enough. The rude effigies which we now discover here may have been the domestic deities of such colonised families ; indeed, the minute emblems, perhaps, of Opis herself, and as such sufficiently interesting to the traveller, though of no real value. It is to be regretted, indeed, that

* Melpom, xxx., and translators note 43. Bryant's Mythology will further elucidate her sacred position in the estimation of the ancients.

† Herod in Clio, cxxxv.

‡ Herod in Erato, xcvii. "Why, oh sacred people, do you fly, thinking so injuriously of me? If I had not received particular directions from my master to this effect, I, of my own accord would never have molested you nor offered violence to a place in which two deities were born."

§ Herod in Erato, cxix. Clesias, Diod. Sicul : and the sacred records of Mehemiah and Ezra, all afford evidence of this custom. Hecren says the Persians extended the practise. Asiat. Hist. chap. xi. 340.

but a superficial glance can be taken only of the ruins in the neighbourhood, for excavations would doubtless divulge many relics of a past age. That Opis itself was a great city there is no question, for the produce of the Indies and even China reached it from the sea by way of Gerrha and the Tigris ;* from whence it was disseminated over Northern Asia and Europe, the merchants, residing on the spot, giving chiefly gold, drugs, grain, and precious stones in exchange, all of which were plentiful enough at the emporium of a country whose revenue at the time of the Macedonian conquest has been computed at £58,000,000 sterling, and which in the time of the Khalifate, remained within two millions of the same amount.†

The awful change that has taken place is not altogether attributable, I am inclined to think, to the degeneracy of the people, and to the excesses of armies that have overrun the coveted lands from Europe on one side, from the Oxus and from Arabia on the others. These inroads doubtless tended in a great measure to deteriorate both the soil and the people; but I suspect there have been natural and recurring causes for so great a depression as we witness in the present day. The rivers themselves in changing their course must have occasioned far greater distress and calamity than the excesses of an invading foe. The summit of Manjúr, as we gaze around, affords a picture of wreck of this nature that could scarcely be conceived if it were not spread at the feet of the beholder. Close to us are the dismembered walls of the old city, and many other mounds of adjacent edifices spread like islands over the vast plain, which is as bare of vegetation as a snow tract, and smooth and glass-like as a calm sea. This appearance of the country denotes some sudden and overwhelming mass of water must have prostrated every thing in its way, while the Tigris, as it anciently flowed, is seen to have left its channel and to have taken its present course through the most flourishing portion of the district; indeed through the immense island which the excavation of the Kátúl-al-

* Vide Commerce of the Babylonians. Heeren's Assiatic Hist. p. 234; Masúdi's "Marújadi Dhahab-wa-Madau-ab johir" p. 315. 324. 328; of Sprenger's translations; and in another chapter we have a comparative rank given of the magnates of the earth, which will show the estimation the country was held in in respect to others in ancient times, by an unprejudiced Mahomedan writer, p. 366. Masúdi says, "the Kings of China of the Turks of India, of the Zá j and all other kings of the earth look up to the king of the climate of Rábit with great respect, for he is the first king on earth and occupies the same position with respect to others as the moon with respect to the stars. For his country is the most *noble and most populous:* he is the richest of all sovereigns; he is most favored by nature; and he has a powerful and firm government; but now (A. D. 332) this description does not at all agree," adds Masúdi, "with the sovereigns of this country." What would Masúdi say could he see it now?

† Ancient Persian history, during the khalifate of Marinin, from a document of Ahmed ibu Mahomed ibu Abdul Hamed, employed at the time in the department of finance.

avoidable in many cases by vigilance on the part of Government and its officers. The change in the channel of the Tigris in a rocky region like that immediately beyond Opis, we must, however, ascribe to another phenomenon, which, though, natural, is but seldom experienced in these tracts. I allude to earthquakes, and have little doubt but the misfortunes sketched above could be traced to an occurrence of this nature. Though faintly felt—perhaps but once in twenty years—in the alluvial district of Babylonia, we know these shocks are constant and alarming in Syria, Asia Minor, and, to some extent, on the west of Persia—countries immediately enclosing Mesopotamia, the northern half of which is, indeed, only a connected rocky flange thrown off, as it were, from the base of the several ranges, having a gradual descent, terminating in the deep hollow of the Persian Gulf. In earthquakes, such as those which have at various times prostrated Antioch and Aleppo, in Syria, the shocks have doubtless been felt in a more or less degree over Northern Mesopotamia, and in my experience some milder concussions have extended to Baghdad and Southern Mesopotamia. During the Khalif Malawakkel's reign, A. D. 850, we have it recorded that for many days the waters of the Tigris, to the great astonishment of the inhabitants of Baghdad, first became yellow, then suddenly changed to the hue of blood; afterwards traced as the effect of an earthquake that had destroyed many towns in Georgia and Persia, and opened new sources for rivers, besides changing the streams.* A visitation similar to this—if not the occurrence of the period—must, I presume, have lopped off a shoulder of the tertiary tract east of Oadesiyeh on the Tigris, in the neighbourhood of the great dams—perhaps adjacent to the Sidd Nimrod, which giving way also on the left bank of the river at the same time, admitted the Tigris, perhaps confined at the juncture, in a vast mass into the plains east of its old course, severing at the moment the Kátúl-al-Kesráwí on the Phuskus from its sources at Al-Kaim and Dur. The deep and narrow watercourses marked on the map in the immediate tract between the new and the old beds will show that the river meandered about for some time previous to setting in its

* D. Hordelok's Biblio Orients, "Matawakkil," a similar change in the color of the Tigirs took place this year (1850) on the 9th August, and lasted to the astonishment of all, for three days; the river, too, which had been falling as usual in these months gradually became stationary, and when the water resumed its general dirty appearance the river fell with a double velocity for two following days. I have no doubt myself but some earthquake has occurred in the hills near the source of the stream, for a fall of rain is unusual in these months and to create such a change must have been excessive.

present channel, thus offering obstacles to the permanency of any plans for its control, which might have been contemplated, from the extensive ravages it was daily committing by being broken in a multitude of streams. The wreck, whenever it happened, must have been complete. The Kátúl has ceased to be a running stream, perhaps, for the last ten centuries, though its continuation, the Nahrwán by the damming up of the Díyáleh, and by other extensive repairs, may have had its existence prolonged to a comparatively recent period. To conclude this subject I cannot refrain from quoting Masúdi, a work not generally read, on the irruption of the Tigris in his time, 332. A Hijreh, Sprenger's translation. p. p. 253—5.

After speaking of the Euphrates he says, "In the same way the Tigris has changed its course," alluding to the districts to the south; and afterwards, "the inhabitants of these places (esh Sherki and Al-kal, villages of Katirbil, at present not identified, though close to Baghdad) have had a lawsuit with those on the eastern side (of the Tigris on the subject of land recovered or lost by change of the bed), who are in possession of Rakkah-esh Shemasíyeh, in the reign of Al-Moktader, &c. &c. What well-informed men have deposed at this occasion, and what we have stated, are well known facts at Baghdád. If the water changes its course in about thirty years the seventh part of a mile, it will make nearly one mile in two hundred years, and if the water of a river retires from its original limit four hundred cubits, the place will be waste. Through these causes places are rendered uncultivated, and if the water finds a declivity or descent it widens by its course and rapidity the bed as it carried the ground away to an immense distance, and wherever it finds a wide and low place it fills it and forms lakes, marshes, and lagunes. By these means places which have been cultivated become deserts, and those which were without cultivation become cultivated. Every body of common sense will understand and appreciate what we have said."

He continues, "All historians who possess just ideas respecting the history of the world and its kings, know that in the year in which the prophet of God sent messengers to the Kesra,* and this was the seventh year after his flight from Mekka and Medineh, the Euphrates and Tigris were so much swelled that they never had been so before; the water made immense breeches and holes which were greater than the

* The Sassanian kings of Persia.

canals, and as the canals could not hold the waters, *the dams and mounds gave way*, and the water filled the lower country. The Persian King Abrawíz (Khúsrú Parvíz) endeavoured to confine the waters again, repair the dams, and to open the trenches, but he was unable to control the river; it took its course towards the place where in our time are the marshes. The cultivations and fields were submerged, and whole districts were changed into marshes which are there at present, his exertions to stop it being inefficient. The Persians were soon afterwards occupied with Arabic wars, they broke through its limits, and no body could turn his mind to the reparation of the dams, so the marshes became wider and more extensive."

"The whole extent of the marshes which the water occupies at present (332 A. H.) is about fifty farsakhs (125 miles about) long and as many broad.* In the centre is a round place in which the ground rises; this is a city covered with water, and when the water is clear, one may see at the bottom the ruins of buildings; some stones are still standing in their places, whilst others have fallen down One may still trace the course of the buildings."

From this account of Masudí, the date of the irruption that destroyed the Kátúl and changed the course of the Tigris to its present position might be assigned to the era of Khúsrú Parvíz. There is scarcely any doubt, however, but that it was in operation as a canal in the time of M'átassem, the 8th Khalif of the Allassín, or he would not have selected its district for his new capital erected at Sámara, contiguous to the line of its course, and protected by the extended arms of the conduit, from whence also it is presumed the restored city derived its water as did the more ancient Sumere, which existed there in Julian's day. It is not, however, unlikely that the several portions, on the elevated soil around, continue to hold water by being dammed up where we see the arms unite in the map, and where dams still exist in the bed viewed as deep trenches above, they were then still able to maintain a large population, and to irrigate as well the tract lying between them and the Tigris.

From Manjúr we traversed the country in a N. E. direction to fix the arms of the canals that have been served by the river from the Kátúl, and which I have noted in my journey of last year. In thirty five

* The Marúj-adh-Dhábabwa M'adan-al-johir of Ma'sudí says during the khalifate of Mo'awíye the state derived a revenue of fifteen millions of Dihreins, (£3,000,000,) from the reeds alone, which grew spontaneously in the marshes. p. 255.

minutes we came on a long duct called the Ejdeh,* having several other similar to it, all derived originally from the Kátúl-al-Kesráwí, now seperated from them by the Tigris. They are noted in the Appendix; and the lines they pursued over the country are also shewn. Ruins of brick-pottery and other remains are strewed on every hand, shewing that the space contained between the old bed of the Tigris to the West and the Kátúl-al-Kesráwí now close on the other side of the Tigris to the east was a densely populated region. The next day was devoted also to the examination of this canal and to following up the canal Al-Ejdeh,† which was the main branch or line to the east of Opis, and in determining the connexion between them and the Kátúl conduit. To continue describing these, offering as they do so much sameness in detail, would be tedious in the extreme: with the exception, therefore, of recording that I was enabled to fix the site of another large town ‡ on the left bank of the old bed of the Tigris on my way to Bagdád, I shall conclude with a general reference to the map and to the appendix, which the observations made at the several positions will be found, and on which the former was constructed. The dry bed of the artificial acqueducts excavated in remote antiquity in the map, are represented by well defined black lines drawn over the face of the country where they are still traceable, and the deserted channel of the Tigris and minor arms, which it must have occupied previous to its settling in its present position, are shown by shaded curvatures such as those pertaining to natural streams, while long decayed towns are enclosed in a broken red-line. A knowledge of this in considering the site of Opis will be necessary to prevent confusion; the bearing in mind, at the same time that the recent or new course the Tigris has followed is marked blue, as also are the canals at present dispensing water, will aid materially in the enquiry, for these must be regarded as non-existing when the brave "ten thousands" and their successors in arms traversed this region, the history of which, whether derived from sacred or profane writers, is in some measure elucidated by the research of individuals, however limited in knowledge or in qualifications. This indeed is my apology for having essayed the identification of the lost Opis, a city which has engaged the attention of our best geographers, and well deserving of a place on our maps, for we may regard it as the primitive "Assembly House" of nations then far distant from each other,

* See appendix Z. † Appendix A. U. B. C. D. F. ‡ Appendix under E.

but connected, in very early times, by a commerce that, alike honorable to all, spread civilization over the face of the globe, the blessing of which England is now enjoying, and which she is endeavouring in her turn to dispense by establishng an "Opis" in the west, which, let us hope, in 1851, unlike its protype on the banks of the Tigris, will prove the foundation of an intercourse conducive to universal harmony and peace. War and its ravages are but too well depicted on the face of the country around this early emporium of our race, and with such examples before us, who can blame the vindicator of peace or the advocates of an enlightened union between communities of men? Let the dweller on the Thames, however humble or hard be his lot in his life, turn aside from the contemplation of his distresses but for a minute, and ere he turns his thonghts from home let him take a glance at the smoking cottages—hovels if you will—and smiling fields around him, and then direct his eye to the banks of these classic streams, where a howling waste has succeeded a picture similar to the landscape before him. Before the ruin was accomplished he will find, if he traces its history, that far greater miseries than his own were endured by its people, and that the horrors of war which, under so long a term of peace, he has no idea of, led to the withering aspect which the features of the once smiling landscape at present bear. The lovers of war and the agitators of the people should also contemplate the scenes which are of every-day occurrence in the land I now write in, overrun as it is by the enemy of his fellow man. The predatory Arab spares not the most needy, compared to whom the denizen of a workhouse and the Irish starveling may be termed happy, but for ever prowls in search of booty of some sort, and to whom the wretched clothing of the miserable wanderers around becomes an object of cupidity and plunder. Once witness of this anarchy and distress the contemners of order and peace would not only bless the laws that protect them, but would appreciate the industry of all classes of men who are laudably striving to uphold the high position England has attained in the scale of nations, while at the same time the Government and a sympathizing community are doing everything to alleviate want,—a privation as unheeded in this country as it is prominent.

(Signed.) FELIX. JONES,
Commander and Surveyor.

Baghdad, 15th September, 1850.

APPENDIX.

Shewing the observations and bearings made on the journey described in the foregoing paper. The latter when taken by the prismatic compass have been reduced to the true pole by daily observations for variation. The latitudes were observed by an excellent sextant of Troughton's, graduated to 10 seconds, used with an artificial horizon and the angles determined in azimuth and horizontal arc by a couple of theodolites, one of 10 inch, where great nicety was required, the other of 4 inches radius, which was carried throughout the journey.

AT A.—Bearings, true.

		°	′	
	Shrines at Kathemein... ...	117	30	
	Tomb of Zobeide...	136	30	
Called Abu Khandal]	A grave on the canal... ...	158	30	¾ mile distant
	Akr-kuf, Babylonian... ...	241	30	Pile—portion of
	Direction of canal to S. E...	148	00	Median Wall?

AT B.—Ahweyneh—Bearing true.

	°	′
Shrines at Kathemein... ...	124	30
Akr-kuf...	233	30

AT C.—Serákha ruin.

	°	′
Shrines at Kathemein... ...	131	30
Akr-kuf.....	229	00

AT D.—Súk—the lower one.

	°	′
Shrines at Kathemein.. ...	136	00
Akr-kuf...	224	00

AT E.—Branch canal from the Serákha.

	°	′
Shrines at Kathemein... ...	140	00
Akr-kuf...	206	30
Road back...	112	00

AT F.—Hummámát.

		°	′	
	Shrines at Kathemein... ...	139	00	
	Akr-kuf..	198	00	
(Ancient)	Tel Abdar...	245	00	About a mile dist.

AT G.—The Upper Súk.

	°	′
Shrines at Kathemein... ...	151	00
Akr-kuf...	198	45
Khán Tarmíyeh...	10	00

AT H.—Tel Goosh.

	°	′
Shrines at Kathemein... ...	166	40
Akr-kuf...	205	40
Khan Tarmiyeh...	355	00

AT I.—Khán Tarmiyeh or Suadiyeh.

	°	′	″	°	′		
Sun's Mer: alt.	113	22	11, gave the latitude...	33	37	0	2 North.
Nitocris's flags displayed in the Jedideh Reach—bore true.				70	00		
An ancient mound called Tel-kir...				211	00		

AT J.—On the high mounds of the Nalhriyat canal by theodolite set 360° to the minaret in Sumeycheh village—a tomb called Ibrahim being exactly in line with it.

	′	′	
Deserted village east of Sumeycheh...	8	56	
	°	′	
Mahomed Abul Husseyn tomb.	16	24	
Kef' Ali...	37	21	
Sheik Jemeel—a tomb, near the Tigris...	56	22	
Extremes of the village Sadiyeh, on the east bank of Tigris... ... ... 57 35 to	62	00	Indifferent.
Mounds in the Abú Sakher ruins...	117	00	One mile distant.
Tel Taaseh...	138	10	
Khán Tarmiyeh doorway...	173	47	
Direction of the Nathriyat canal for mile—then turning to the E. S. E... ...	168	00	
Sun's altitude—centre for azimuth...	12	37	
Angle to sun's centre for do...	171	02	
Theodolite magnetic, shewing North...	354	00	
Direction of canal coming from...	336	00	
Sun's amplitude as set by compass...	274	00	
Sun's amplitude as set by theodolite...	279	36	
Making the variation of the road compass...	3	12	West.
And by the theodolite needle.	2	43	30″ West.

The mound of Abú Sakher by a mer. altitude of the sun on the following day, March 23rd, 1850, observed as 113° 57′ 10″ Being in latitude 33° 42′ 4″ North.

AT K.—Kef' Ali, tomb in Akbara.
Sheik Jemeel, a tomb near the West bank of the Ti-

	°	′
gris—having in one with it the date groves of Sadiyeh	63	30
Mahomed Abul Husseyn tomb	346	30
Minaret in Sumeycheh village	326	30
Direction of the bed of the Shatayt for one mile and a half...	11	00
Extremes of Mansuriyeh groves...	80 to	100
The direction of the Shatayt bed to south...	149	00
Wâneh or Awâneh, ruins of...	152	30
Station of last night on the Nalhríyât...	208	00
Sheikh Ibrahím tomb... ...	255	00

AT L.—Station on the plain 1 mile true east of Sumeycheh minaret; the ∠ mer. alt. of A. Canis Majoris was observed as 79° 18′ 5″ on the night of 23rd March, having the latitude of the village mosque 33° 50′ 48″ North.

AT M.—True bearings observed from the minaret of Sumeycheh.

	°	′
Minaret of Beled village.....	336	15
Centre of straggling date grove N. E. of it... ...	343	00
Tomb of Syed Mahomed... ...	346	00
Date groves of Sindiyeh just discerned...	76	00
Mahomed Ab'l Husseyn tomb	114	00
Kef Ali tomb...	146	00
Mathriyat and Sheikh Ibrahim tomb in line... ...	172	00
My station on the Kâtûl, or Nahrwan, where it is broken by the Tigris and whose latitude is ascertained by means of many observations as 34° 00′ 37″ Its chronometrical difference of longtitude, west of Baghdâd, being well fixed in three trials is 3′ 45″	28	00

The altitude of Sumeycheh minaret was found also by sun's mer. alt. on 24th March, as 33° 50′ 45″ from ∠ 114° 29′ 25″ ⊙ altitude.

AT N.—Station on Hyr, tumulus.

	°	′
Sumeycheh minaret... ...	192	30
Syed Mahomed tomb.. ...	336	15

AT O.—On the tomb of Syed Mahomed.

	°	′
Minaret of Beled village.....	295	00
Syed Saadí, a tomb in the ruin of Harbeh...	262	00
Syed Gharyb, a tomb on the W. Bank of the Dijeil.. ...	195	00
Khan Mizrakji, on the East bank of the Tigris... ...	205	00
Malwiyeh—spiral tower... ...	307	30

Khan Dholoiyeh... ...	28	00	
Nitocris, in the bight of Tigris, leading to opening of Shatayt...	77	30	
Sumeycheh minaret.. ...	166	00	afterwards found to be Tel Manjúr.
A high mound to the E. S. E.	132	00	afterwards found to be Tel Manjúr.

AT P.—A branch of the Kátúl-al-Kesráwí. emanating from near the "dam" found in the bed of the Alkaim branch of the old conduit. This station is a centre spot from which other canals diverge, as follows:—No. 1, 2, 3, 4, 5.

	°	′	
Syed Mahomed...	274	00	
Sumeycheh minaret... ...	180	00	or due South.
No. 1, Branch from which the others were supplied; its connecting arm being on the opposite bank of the present Tigris...	31	30	Extends to cliffs of the river.
No. 2, a canal 15 yards broad.	320	00	Extends to cliffs of the river.
No. 3... do... do... do...	255	00	
No. 4.... do... do... do...	186	30	
No. 5... do... do.. do...	113	30	Curving.
Khan Dholoiyeh...	344	30	
Nitocris's flags...	296	00	

N. B.—The mouth of the Shatayt, half way between this position and the place where "Nitocris" is at anchor.

AT Q.—Tel' Aabr, on the east bank of the ancient bed of the Tigris.

	°	′	
Syed Mahomed tomb... ...	23	30	
Beled minaret...	341	00	
Syed Saadí, tomb in Harbeh.	305	30	
Sumeycheh minaret... ...	152	30	
Syed Gharyb tomb... ...	186	30	

AT R.—Tomb of Syed Saadi, in the ruins of Harbeh.

	°	′	
Malwíyeh at Sáma.. ...	318	00	
Khan Mizrakjé...	330	00	
Minaret, of Harbeh, ruined ...	291	30	
Minaret of the modern Beled...	41	30	
Khán Dholoiyeh...	51	30	
Syed Mahomed tomb... ...	81	30	

AT S.—Fallen Minaret in the ruins of Harbeh.

	°	′	
Malwíyeh...	319	00	
Khán Mizrakjé..... ...	336	00	
Belled Minaret..... ..	57	30	
Syed Mahomed tomb..... ...	86	30	
Syed Saada tomb...	111	00	
Syed Mahassin tomb, on the other side of the Dijeil...	207	00	

AT T.—Near the mounds of Jibbáreh, just above the dry canal of Al'Alth.

	°	′	
Khán Mizrakjé...	18	00	
Harbeh...	138	00	
Beled Minaret...	112	30	

AT U.—The bend of the Dijeil canal, where the ancient Izhakí conduit is severed by it, and where the N E. extreme of the Cháli joins the west bank of the latter. Here, too, on the eastern side of the Dijeil, the Al'Alth, and Mastansir ducts are led off, and the Fethátiyeh, another modern duct derived from the west bank of the Dijeil, is seen running parallel with the east bank of the old Izhákí, whose direction is quite straight in a line of.. ..... 163° 00′

Khán Mirákjí.....	38	00	
Direction of the Mastansir...	75	00	Irregular
Syed Soadi...	123	00	Tomb.
Abúl Mahassan tomb...	155	00	
Malwíyeh...	325	00	
Alkaim, lower..	309	30	
Direction of the Chálí, or Sidd Nimrúd...	206	00	

AT V.—Opening in the rampart Chálí Balikh, leading to the valley which formerly received the water from its reservoir.

Malwíyeh tower...	339	00	
The continuation of the ridge on the opposite side.....	209	30	
Direction of canals on either side of the *valley*... ...	98	00	1st
	170	00	2nd

AT W.—At the position of a bridge across a canal from the Kátúl-al-Kesráwí, which watered the town north of Tel'Aabr.

	°	′
Direction of the canal..... ...	145	00
Tel'Aabr...	179	00
Syed Mahomed..	36	00
Syed Saadí..	290	00

AT X.—Tel Dhahab, "gold mound."

Syed Mahomed...	350	00
Syed Saadí...	290	00
Tel'Aabr.....	263	00

AT Y.—The High mound of Manjúr.

	°	′
Syed Mahomed...	308	30
Syed Saadí...	286	30
Flag on the Nahrwán or Kátúl-al Kesráwí... ...	46	30
Another mound, a portion of the wall of the old city...	76	30
Sumeycheh Minaret... ...	191	00
Another mound, part of the wall of the old city... ...	26	00

And at this mound were observed the following:

Flag on Nahrwán... ...	55	00
Syed Mahomed... ...	286	15

And the mound noted as 76° 30′ from the high mound of Manjúr nearly in line Abu'l Hassan.

On another portion of the wall of the city of Manjúr.

	°	′
Manjúr, or high mound... ...	136	30
Syed Mahomed...	284	00

In the valley formed by the 'Alheim in a very early period, just west of Manjúr mounds.

	°	′
Mound on which the above bearings were taken... ...	39	00
Manjúr...	166	30

On another mound forming a portion of the old wall of the city of Manjúr.

	°	′
Nahrwán flag...	48	30
Mound of yesterday... ...	325	00
Manjúr.....	221	00
Mound taken from Manjúr...	193	00

At Z.—Various stations on the Ejdah and neighbouring canals, the former a great arm which emanated from the Kátú-al Kesráwí, about a mile west of the valley of the Atheim.

	°	′
Nahrwán flag...	57	00
Direction of canal to where severed by the Tigris... ...	336	30
Ditto in its course to Ejdah, high mound of ruins... ...	160	00
Syed Mahomed...	270	00

On canal next east of the Ejdah duct, 50 yards broad. Its course 325° and 139° opposite. On 2nd canal east of Ejdah.

	°	′
Syed Mahomed...	266	30
Mouth of the Atheim river...	330	00
Nahrwán flag...	58	30
Direction of canal to S. E...	170	00

On the Ejdah canal, where it is severed from the Kátú by the Tigris: its breadth about 60 yards.

	°	′
Nahrwán flag...	73	00
Syed Mahomed..	264	00
Dholoiyeh Khán...	303	00
End of Háwi...	81	00
Direction to canal, to station on it of yesterday... ...	160	00

On another large mound of ruins for which the guide has no name, (one mile?) east of Manjúr or Opis.

	°	′
Nahrwán flag...	36	30
Syed Mahomed...	288	30
Another mound of ruins, distant a quarter of a mile	1	00
Another larger heap of mounds distant three quarters of a mile	189	00
At Ejdah canal mounds. ...	136	15

On the mounds of Al Ejdah canal, where an ancient city of great extent formerly stood.

	°	′
Direction of Al Ejdah canal from this to the Tigris... ...	350	00
Direction from this position...	148	00
Nahrwán flag...	11	00
Syed Mahomed...	296	00
Minaret of Sumeycheh...	220	00
Our position this evening on the Tigris...	56	00

At a.—On canal to East of Ejdah, Tigris Cliff, half a mile north of position; and the Kátúl formerly ran where the Tigris now flows.

	°	′		°	′
Flag on Nahrwán... ...	329	00			
Direction of the canal, back on	337	00	and	158	00
Sumeycheh minaret... ...	225	00			
Syed Mahomed...	281	00			

Another long canal running here parallel to this about half a mile to the south.

A.—On the canal specified in last line.

	°	′		°	′
Sumeycheh minaret.. ...	230	30			
Nahrwán flag...	335	00			
Direction back and on... ..	339	00	and	163	00

Extensive ruins quarter of a mile S. W. of this.

At b—On a canal which the guide calls Aghab, branch of Kátúl.

	°	′		°	′
Sindíyeh village...	45	00			
Extremes of Saadiyeh groves *(c)*	87	00	to	124	00
Some high mounds with a dry canal, formerly led from Kátúl to this spot...	101	00			
Sherkh Jemyl, the canal curving to the right of the tomb.	200	00			
Sumeycheh minaret.. ...	273	00			

At c.—At Sheikh Jemyl, a modern tomb.

	°	′		°	′
Kef' Ali in the ruins of Akbara...	243	00			
Sumeycheh minaret.. ..	291	00			
Sindíyeh...	38	00			
Extreme of Saadíyeh. *(c)* ...	51	00	to	67	00
Ditto of Mansúríyeh. *(c)*	129	00	to	152	00

At d.—At the Tarmíyeh canals. Old ducts now seen to correspond with those on the opposite side of the Tigris; branches or derivates of the great Kátúl, called **Tarmíyeh**, because a modern cut leads the Tigris, when high, into the Tarmíyeh lake; another name is Chíl.

	°	′
Sindíyeh and islet of Mansuríyeh in one...	25	00
Also the Saadíyeh (west end) grove...	28	00
Sheikh Jemyl, modern tomb...	339	00
Kef 'Ali..		
Direction of these ducts... ...	263	00

Another running in the same direction quarter of a mile north.

At e.—The ruined city of Al Busára, on the left bank of the old bed of the Tigris. A large town having a citadel and outer rampart surrounding it. Bed of the river deep and well marked full of grass and cultivations, the produce of the spring rains. This city is mentioned in the Kitab-al-Akalim, beyond this notice I can find no clue to its history. Ruined material on every hand.

Kef 'Ali...	321	20				
Sheikh Jemyl, with the curve of the old bed of the Tigris, and boundary of the ruined city in one..	13	30				
Khan Tarmíyeh...	202	00				
					°	′
Extremes of Howeysh and Dokhleh *(e)*	121	00	to	101	38	
Small clump Howeyreh... ...	88	30		°	′	
Extremes of Mansúríyeh *(e)*...	51	00	to	36	00	

At f.—At a centre spot where ancient canals diverge, called the Medoad, also led originally from the Katúl-al-Kesráwí.

	°	′				
Direction of its source..... ..	24	00				
Khan Jedideh.....	120	00		°	′	
Extremes of Howeysh trees *(e)*	78	00	to	69	00	
Howeyreh clump...	63°	00				
Tarmíyeh Khán...	219	00				

Kathemein Domes, due South; indistinct.

(True Copy)

(Signed) FELIX JONES, Commissioner and Surveyor.

A. MALET, Secretary to Govt.

Art. III.—*The Volcanoes of India.* By Dr. Buist.

VOLCANOES.

1. In touching in last year's Report on the subject of volcanoes and volcanic appearances, real or supposed, in India, I was led to the conclusion that there were in all likelihood not a few of these which wanted sufficient proof to satisfy us of their reality ; and I instanced two cases as probably belonging to this category—that of the eruption in the Zebayer Islands, described by Captain Barker as seen in 1846, and the luminous appearance off the coast of Arracan, which, in my inability of lay my hands on the account of the matter which I knew had been published somewhere, I thought very likely to have been the result of some of those luminosities which are now known to be of such frequent occurence at sea. On both points I have since seen good reason to change my opinion, and the occasion of making the required correction seems to be a favourable one for the preparation of a short paper on volcanic phenomena in India. My own means of observation have been in this matter very limited—the only volcanic regions I have actually examined are those to the westward of Kurrachee, and on the South Arabian coast, and those of the Red Sea. Much of the most important information in existence on the snbject lies hid in the Reports of the Meetings of the Bengal Asiatic Society, which have unfortunately not been indexed, the Table of Contents and Index to the Papers affording no light as to what occurs at the meetings. The subject is the more important as it is obvious from the latest editions of the works of Sir C. Lyell and Mrs. Somerville that they have fallen in with only a small portion of what has been published on the volcanic phenomena of India.

The following letters will set the question as to the Zebayer eruption completely at rest :—

"Sir,—With reference to an article which appeared in the *Bombay Times* of 9th ultimo, wherein you supopose 'I was misled by appearances, in mistaking the smoke issuing from the *Hindostan* steamer, for smoke issuing from the summit of

Saddle Island, one of the Zebayer group,' I beg to forward the accompanying statement from Captain Lovell, of the P. and O. steamer *Oriental* (but at that time in command of the *Hindostan*,) by which you will perceive it to be impossible I could have made such a mistake; and it will also account for Captain Lovell not noticing the smoke issuing from the island, inasmuch as we must have been in a line with the island from the *Hindostan* at the time she saw us. I am perfectly convinced there was neither mistake nor delusion. The smoke was first pointed out to me by the Assistant Surgeon, Nicolson, and seen by all on board the *Victoria*, not at one moment, but at different periods; and at the time it was first seen, the *Hindostan* was to N. N. W. of the Quoin Rock, the northernmost of the Zebayer group, and distant from the *Victoria* at least 16 or 18 miles, in a contrary direction. I should not have been justified in approaching nearer to the island as we were "dead to windward of it," and it was blowing violently. The vessel's speed being reduced from 7 to 4½ knots per hour; force of the wind 9, height of waves 5.—I remain, dear Sir, yours faithfully,

J. W. Barker, Commander, Indian Navy.

P. S.—With regard to no notice having been taken of the explosion by the native craft, you must bear in mind that the island is quite out of their track, inasmuch as they always navigate the inner channel; and even supposing they had seen it, they would probably have viewed it with the same apathetic indifference our Arab pilot did—merely exclaiming, 'Verily, it is the work of evil spirits.'

14th August, 1846.

8 A. M.—Passed Jibbel Teer all sail set, with a light breeze from Nd.

9.—A heavy black cloud, rising rapidly from the S. W., which in half an hour formed into about a dozen large water-spouts.

10.—Saw the Quoin Rock.

10.30.—The squall burst upon us with heavy rain and blowing furiously, with much lightning and a continuous roll of thunder, which had a very peculiar sound, as if close upon the water. Hauled out S. by W. Ship steering previously S. S. E. At 11.30 the rain abated a little: saw the Zebayer Islands bearing easterly, distant about 7 miles—and a steamer between us and the islands, distant from us about 4 miles. The weather continued thick and squally, with much lightning, till we got as far as Mocha.

The Barometer was very slightly affected by it.

Henry P. Lovell,

Acting Commander Steamer *Hindostan*.

TO THE EDITOR OF THE "BOMBAY TIMES."

"Sir,—In your paper of the 14th September, under the head of Transactions of the Bombay Geographical Society, you give a long extract from a report furnished in 1846 by Commander Barker, of the Indian Navy, regarding a strange appearance presented by one of the Zebayer Islands in the Red Sea. This report is quoted by you with the view (as you suppose) of strikingly illustrating the fact, that men are apt to jump at strangely erroneous conclusions when they allow more play to a fertile imagination than to the ordinary forms of observation That Commander Barker was not thus misled, and that his imaginative faculties did not afford him the slightest aid in making this report, but that he simply stated what he saw, is very soon and very easily proven. As I was on board the steam-vessel *Victoria* at the time that Commander Barker alludes to,—and as I believe I was the first person that noticed the singular appearance detailed in his

report,—I consider myself called upon to prove that it was not an ocular delusion. I noted down, at the time, all the circumstances relating to this sudden outbreak of Saddle Island, and I can do nothing better than give you the substance of my notes, from which you will at once see that your explanation does not tally with the facts of the case:—'14th August 1846, off Sobayer Islands, lat 15° 7′ long. 42° 12′, on the voyage to Suez. The whole forenoon has been calm and excessively sultry. Skies overcast; particularly dark and threatening towards the N. W. Thermometer 95°. Sighted the Peninsular and Orient steamer bound for Aden: she passed about four miles to the west of us as we were closing in with the group of islands. Soon after she passed a violent squall from the N. W. burst upon us.* It was accompanied by a drenching shower of rain, heavy peals of thunder, and vivid flashes of lightning. Ship going about eight knots during the forenoon—reduced to three knots when the squall came on; temperature brought down to 80 degrees. Passed along the western side of the Sobayer group of islands. When opposite to Saddle Island (one of the Sobayer group,) and only about three miles distant from it, observed a column of smoke issuing from the summit of one of its cones. The squall was then at its height. The column gradually increased in size, while, at the same time, distinct jets of smoke issued, as if from numerous small apertures round the outer margin of the cone. Before the squall burst, the summit of the island was perfectly clear. After passing the island, and while it continued in sight, we observed the smoke. This sudden change affected almost every one on board, less or more, with a feeling of languor and depression of spirits: several individuals, and I myself was one of them, complained of great uneasiness and sickness at stomach.' This is the substance of my note, and it clearly shows that your mode of explaining away is without any foundation in fact, for both steamers passed along the same side of the Zebayers, and when we first observed the smoke issuing from Saddle Island, which was then due east of us, the Bengal steamer was well down nearly due south of us, while the wind blew very fresh from the N. West.

Suez, 6th November, 1850." J. G. N."

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* This furnishes one more illustration to the hundreds we possess of the intimate connection betwixt earthquake, volcanic, and meteorological phenomena so well adverted to by Captain Baird Smith. During the *Cleopatra's* hurricane of the 19th April, 1847, and again at the period of the land squall on the 6th April, 1848, the magnetic instruments at Bombay continued in a state of great disturbance for upwards of two days.

The following note of the loss of polarity bythe needle during a whirlwind is given in a letter in the *Bombay Times*, May 30, 1846:—

"There is a class of magnetic local perturbations apparently confined to these seas, one of which was experienced by the *Queen* on her late voyage from Aden, which we do not remember to have seen noticed by magneticians. When about three hundred miles from Bombay the people on board the steamer observed the atmosphere get suddenly clouded all around with that strange lurid appearance which indicates the approach of a burst of rain or hurricane. By and bye appeared overhead those strange and turbulent vapours commonly attendant on a whirlwind or waterspout,—and a light whirlwind accordingly made its appearance. At this time the magnetic virtue of the compass appeared to vanish: the needle lost its polarity, and traversed equally in all directions. A state of matters so surprising was of short endurance: the sky cleared without a tempest, and all went well again. It is we think about two years since an accident of this sort was met in with by the H. C. schooner *Mahi* on her way from the Persian Gulf. She was surrounded by beautiful groups of whirlwinds and waterspouts ranging about her in all directions, when suddenly the needle lost its polarity and continued for some time useless for the purposes of steering. We are unable to lay our hands on the account of the circumstance published at the time, but remember perfectly of its occurrence.' To these we may add many others. Dr Baddeby has clearly established the fact that our lesser whirlwinds at all events are either due to direct electrical agency, or, at all events, are characterised by the most striking electrical exhibitions.

The occasion of making these corrections seems a most suitable one for throwing into a connected form the information that lies scattered up and down in a multitude of different quarters in reference to volcanoes in India, meaning by this general term within the region betwixt Burmah and the Red Sea, between the parallels of 10° and 30°. These consist of the group betwixt Barren Island and Chittagong, which terminate the vast Molucca band—of the band stretching westward, consisting mostly of hot springs and mud volcanoes betwixt the Nerbudda and the sea coast of Luz—a range of above 500 miles in length, and the magnificent region extending from Aden to near Ankobar, betwixt 10° 12° 45′ and N. lat. and 40° and 45° E. long.—a base of full 400 miles, and extending to Gibbel Teir, 15° 30′ N., a distance of 350 miles, with probably little diminution, in its breadth.

VOLCANOES IN THE BAY OF BENGAL.

"One of the most terrible active groups of volcanoes in the world," says Mrs. Somerville, "begins with the Banda group of islands, and extends through the Sunda group of Timor, Sumbawa, Bali, Java, and Sumatra, separated only by narrow channels, and altogether forming a gently curved line 2000 miles long; but as the volcanic zone is continued through Barren Island and Narcandam in the Bay of Bengal, (lat. 12° 15′,) and northward along the entire coast of Arracan, the entire length of the volcanic range is a great deal more."* The band is not, as will presently be seen, limitted to Arracan, but extends northward to Chittagong, lat. 22,° or 600 miles beyond Barren Island. The first description we posses of the volcano in question is that of Lieutenant Colebrook,† who visited it in 1787, when it was in a state of violent activity; he does not seem to have landed on it, and he quotes entire the account of it given by Captain Blair in his survey of the Andaman Islands. The cone, which springs from near the level of the sea, rises at an average of 32° 17′, to 1800‡ feet nearly. Mr. Lyell gives the following account of it—he quotes Von Buch as his authority, a work I have not been able to consult:—"Barren Island, in the Bay of Bengal, is proposed as an illustration of the same phenomena" (that

* Physical Geography, vol. i., p. 257, Ed. 1851.
† Asiatic Researches, vol. iii. p. 396.
‡ Later authorities make it 500 feet, and this is probably its true altitude. Captain Blair gives no separate representation of it on his chart; he merely sets it down as a volcano.

of ancient craters, of elevation, as contrasted with modern craters of eruption) " and here, it is said, we have the advantage of being able to contrast the ancient crater of elevation with the cone and crater of eruption and its centre. When seen from the ocean this island presents on almost all sides a surface of bare rocks, which rise up with a moderate declivity towards the interior : but at one point there is a narrow cleft, by which we can penetrate into the centre and there discover that it is occupied by a great circular basin, filled by the waters of the sea, bounded all round by steep rocks, in the midst of which rises a volcanic cone, very frequently a source of eruption. The summit of this cone is 1690 French feet in height, corresponding to that of the circular border which encircles the basin, so that it can only be seen from the sea through the ravines."*

Barren Island was visited by Dr. John Adam in 1831. The water close in shore was then hot and steamy, while steam and smoke issued from the crater, but no lava or flame. He estimates the diameter of the base at about 800 or 1000 yards, and the orifice of the crater, which occupies the entire summit of the cone, at about 30.† The latest description that has been published of Barren Island is that of Captain Miller, who visited it in 1834.‡ His account of it is the same in its general features as that of Lyell, but he estimates the altitude of the cone at no higher than 500 feet ; and considering the limited distance to which it is visible at sea, this seems to be more correct than the other estimates. He sets down the slope of the cone at 45, which would give an altitude of above 1,000 feet, were Dr. Adam correct as to the diameter of the base. He states that it could only be ascended by climbing, and it is probable that Captain Blair's assumption of 32.17, which was determined by measurement, may be near the truth. The volcano, like the others along the bay, is chiefly active during the S. W. monsoon.

Next to Barren Island is the volcanic island of Narcandam, lat. 13° 22′. The cone is about 800 feet high, no soundings are to be had within half a mile of the shore.§ Crossing over to the other side of the

* Element, 1830, vol. i. p. 390.—This seems to be taken from Capt. Blair's estimate of 1800, since upset, as already stated, by Captain Miller, Dr Adam, and others.
† Bengal Asiatic Transactions, 1832, vol. i.
‡ Calcutta Journal of Nat. Hist., 1843, vol. iii.
§ Report of Calcutta Coal Committee, 1839.

bay, where perfect tranquility seems for nearly a century to have reigned, we find a period when the Coromandel coast was as much moved by volcanic agency as that of Arracan itself.

The earliest account we possess of any actual eruption in the Bay of Bengal is that contained in the 1st vol. of the Annual Register, 1776, reprinted in the Bengal Asiatic Transactions of 1847.* It was written by an officer on board a French East Indiaman, and addressed to his friend at the Hague: there seems no reason to question its perfect accuracy. In July, 1757, fires were seen from Pondicherry to break out on the surface of the sea three or four leagues from shore. These blazed out with the greatest fury, throwing up pumice stone and combustable matter. This was accompanied by a noise like thunder, or the discharge of heavy ordnance. An island a league in length and about the same in breadth, with a cone and crater in the centre, then appeared. A vast quantity of dead fish were afterwards seen floating on the surface of the water, destroyed by the eruption. The sea was some days afterwerds so covered with pumice stone that vessels found it difficult to make their way through it, while they ran the risk of being burnt from the showers of hot ashes with which the air was darkened. The island seems speedily to have subsided again, as we hear no further mention made of it. A shoal, called the Goris Bank, was seen by H. M. S. "Melville" in a line joining Pondicherry† and Chittagong, and a shoal is noted on an old chart as having been met in with by an American ship in the line betwixt Pondicherry and Chedooba: both these have since then disappeared. Mr. Piddington remarks that the middle of last century was the great epoch of earthquakes all over the world.

In 1750 Chili was visited by an earthquake, by which the town of Conception was destroyed: the sea rolled over it, and the entire port from thenceforth became useless. The whole shore seems to have sustained an upheaval of about 24 feet; and shells similar to those found in the adjoining seas are now abundant on

* Bengal Asiatic Transactions 1847, vol. xvi. p. 499. Reports and Asiatic Researches, vol. i. p. 175. The papers of the Bengal Asiatic Society are indexed: the vast amount of most valuable information contained in the Reports can only be found by reading them through. This is the case with nearly the whole of that relating to volcanic phenomena.

† Abridged from the remarks of Mr. Piddington on the subject of eruptions.—Bengal, Asiatic Transactions, at supt.

mountains above 1000 feet high.* On the 15th September, 1751, the capital of St. Domingo was destroyed by an earthquake, and part of the coast, 20 leagues in length, sunk down, and has ever since formed a bay of the sea. The Lisbon earthquake, one of the most fearful on record, occurred in November, 1755, and in 1757 the Azores were struck with an earthquake, during which eighteen small islands arose, about 200 yards from the shore: these corresponded very closely with the Pondicherry explosion.†

The volcanic region in the Bay of Bengal seems about this time to have been in a state of general activity. Off the coast of Arracan, lies an island called Chedooba situted in lat 18°50′ N. and long. 90°40′ fifteen miles in length and seventeen in breadth, or of about 200 square miles in area. Its general appearance is that of a fertile, well-wooded island, of moderate height and irregular outline. A band of level land, covered with fragments of coral, shells, and gravel, and but a little way elevated above the sea, surrounds it: three distinct terraces are visible, the result of so many separate upheavals.‡

There are four large volcanoes in Chedooba, detached mounds rather than cones, varying from 100 to 1000 feet above the level of the sea. They are composed of stiff grey clay, with large quantities of singular fragments of stone: their sides are much cut up with rain; their summits, which are from 50 to 240 yards in diameter, are quite bare.§ On the summits of these are numerous well-formed cones, from a few

* Lyell's Elements, vol. i. p. 440. Edition 1850, p. 431, gives it 1848 English feet.

† The following extract is from Dr. Thomson's paper on the Geology of Bombay (Mad. Lit. Trans.) It bears directly on the subject, and carries us three centuries further back: I have not considered the description specific enough for the text, but see no reason to doubt the authenticity of the fact:—"The Island of Vaypi, on the north side of Cochin, rose from out the sea in the year 1341: the date of its appearance is determined by its having given rise to a new era amongst the Hindoos, called Puduvepa, or the new introduction. Contemporaneously with the appearance of Vaypi the waters, which during the rainy season were discharged from the Ghaut, broke through the banks of the channel which usually confined them, overwhelmed a village, and formed a lake and harbour so spacious that light ships could anchor where dry land formerly prevailed."—Bartolome's Voyage to the East Indies. Rome 1796; Translation 1800.

‡ Capt. B. Smith, in his admirable paper on Indian earthquakes, published in 1842, Bl. As. Trans. vol. xii., gives an account from the "Gentleman's Magazine" of a violent earthquake which occurred at Calcutta in 1737. Twenty thousand vessels of various sizes are said to have been destroyed by the inundation which accompanied it, and 30,000 lives are said to have been lost on the occasion. No volcanic phenomena, strictly so called, seem to have attended it. It took place during a furious hurricane. The earliest Indian earthquake of which particulars are given is that which accompanied the hurricane of 26th May, 1618, by which 2000 lives and 60 vessels are said to have been lost at Bombay. See Madras Lit. Trans., 1837, already quoted from Gower's Portuguese India, tome iii.

§ Abridged from Capt. Halsted's Report on the Island of Chedooba. Bl As. Trans. 1841, vol. x. p. 434. Capt Halsted gives maps of the Islands of Chedooba and Regnan, adjoining to it. The latter is copied into Johnstone's Physical Atlas, map 3.

inches to four feet in height, and about the same in diameter. On the outside they are hard, within they are filled up with a thick, uniform, well-mixed mud, which every now and then runs out at the side, or over the edge of the crater, bubbles of gas rising at intervals of three or four minutes. There is no appearance of eruptions, of lava, or scoria, or vestige of the agency of actual fire : some of the volcanoes throw out hot sea water in place of mud : they are most active during the rains, and then occasionally emit flame and stones, as well as mud, throwing these to a considerable height : the stones are obviously torn from the beds through which the water passes ; portions of copper occasionally adhered to them. Petroleum wells abound here, as they do all round the neghbourhood. Capt. Halsted visited Chedooba in 1841, and his survey in the " Childers" extended above 100 miles along the coast. The shore here is marked by three well-defined terraces, or raised beaches, covered with coral and shells, and manifestly the result of three distinct upheavals, with considerable intervals—of just a century, the natives believe, betwixt them. The uppermost of these is less conspicuous and distinct than the two lower, but on the western coast a remarkable column of rock stands out on the beach, about 40 feet high, with oyster shells still attaching to it, showing the second line of beach, just thirteen feet above the first. The last of these was said by an old man of 106, who remembered it when he was a lad of 16, to have occurred about the year 1750.* Mr. Piddington suggests that it is not unlikely that it may have occurred simultaneously with the eruption at Pondicherry in 1757—natives being proverbially inaccurate as to dates—during the occurrence of violent earthquakes, when the sea washed several times over the lower part of the island, and then permanently retired as the land emerged. Captain B. Smith thinks it likely to have occurred during the Chittagong earthquake of 1762. Immense quantities of fish were found on the recovered land, and the feasting which occurred on these is still a favorite tradition in the island : no rent occurred in the earth, and no lives were lost, or mischief occasioned : for more than half a

* Mrs. Somerville (Physical Geography, vol. i., p. 254.) speaks of these as the result of gradual upheavals going on within the last hundred years : it appears to have been the effect of a sudden and instantaneous elevation, occurring just a century ago. There is no evidence of any subsequent change of level having occurred within this period along the shores of the Bay of Bengal.

century much of the soil remained salt. The elevation has been greatest towards the centre of the line examined, where it is twenty-two feet; at the terminations it is thirteen, and at Foul Island nine. Regwan, lat. 18° 37′49″ just to the north of Chedooba, is marked by three distinct risings,* each about eight feet: the outer portion of the island was said to have been raised about 1760—most likely, as Mr. Piddington, supposes, 1757. The original island contains two terraces, about nine feet high—the outer margin is as yet barren; it consists generally of corals, shells, and gravel; the rest is a level plain of rice fields.

In the adjoining island of Ramree, or Rumbree, off Kyouk Phyoo, there are some beautiful mud volcanoes, the cones of which are almost all covered with luxuriant casuarina trees—the only places where they are found in the the neighbourhood. The craters and expelled matter possess the same general characteristics as those of Chedooba.† This was first described by Lieut. Foley, in vol. 4th of the Asiatic Journal; the cones are said by him to vary from five to 1500 feet, one peak, called Teeka, reaching the altitude of 3000. Vapour and flame were seen to issue from one of the peaks during the earthquake of 26th Aug., 1833.

There are various hot springs at Chittagong subject to periodical eruptions, and which constantly emit gas and flame.

There is a small volcano near Kyouk Phyoo in a constant state of of activity, and which frequently emits smoke and flame. Cottages at the distance of four miles from it were on the occasion of the eruption of 1842 brightly illuminated, yet so little was the heat that the specimens from the crater were nowhere melted.

Within little more then ten years of the elevation of the Islands off Arracan a catastrophe, precisely the opposite of that from which Chedooba suffered, overtook Chittagong. During the great earthquake of April, 1672, sixty square miles of the lowlands along shore were permanently submerged: Ces-lung-toom, one of the Mug mountains, entirely disappeared, and another sunk so low that its summit only remained visible.‡ Four hills are described as having been violently rent asunder, leaving open chasms, varying from

* Note of Lieut. McVolloth, R. N.—Map of Regwan. Bl. As. Trans; Johnstone's Physical Atlas.

† De Spry. Bl. As. Trans. 1851, vol. x. p. 1845.

‡ Phil. Transactions, 1763, given entire in Capt. Smith's paper on earthquakes, Bl. As. Trans. vol. xii. p. 1047, quoted in Report of Coal Committee, republished in the India Review, 1839, p. 71. I have introduced the passage into the text nearly unaltered.

thirty to sixty feet in width. Other mountains and hills were variously disturbed; some were partially thrown down so as partly to disturb the courses of rivers. One eminence became degraded by little and little till it returned to the level of the plain. In the plain the earth opened in several places, throwing up water and mud of a sulphureous smell. At Barcharra 200 lives were lost on a track of ground that sunk suddenly. It is said that at Arracan the effects of the earthquake of 1772 were not less fatal to human life and property than those of the Lisbon one in 1755; while at Dacca the waters rose so suddenly as to throw all the boats on shore, on its retirement sweeping multitudes of human beings away. From the notices of islands now no longer to be found on the western shore of the Bay of Bengal, in the accounts of Arab navigators, there can be no doubt whatever that numbers of these have been from time to time submerged.*

About an hour after sunrise on the 26th July 1843, the inhabitants of Chedooba and Flat Island heard a great noise, and saw fire rising out of the sea; an earthquake had been felt just before;—this continued for four days, when on the 29th a small island seemed to arise above the surface of the waters. It continued visible for about a month, but it was now the monsoon, and the weather was too boisterous to permit of its being approached. In October, on the return of the fine season, search was made for it, but no trace of it could be found. A careful survey of the spot was afterwards instituted by order of Government, but no indication of commotion, and no change in the aspect of the shore, or bottom of the sea was discoverable.†

On the 2nd Jan., 1845, between the hours of six and seven p. m., about an hour after sunset, the people of Kyouk Phyoo, on the coast of Arracan, were astonished to see the eastern horizon to seaward become brightly illuminated: it continued flickering, like the reflection of distant flame from a ship on fire, for about half an hour, when suddenly immense volumes of flame were seen to burst as if from the depths of the ocean, presenting the most sublime and awful spectacle to beholders. It was occompanied by a low continuous rumbling sound, which seemed to ascend from the bowels of the earth, and was re-echoed from the hills around. The duration of the exhibition is not mention-

* Mr. Torrens, Bengal Asiatic Journal. Reports, Feb., 1845, p. xxvi.; Ibid, p. xxii.
† Ibid, Dec., 1843, vol. xii., Ibid, vol. ii., p. 1117.

ed, though it was seen by many witnesses : it seems to have been very transient. A vessel was sent out to sea immediately, under the impression of its being a conflagration, but saw nothing. Government, on being applied to by the Asiatic Society, instituted a careful survey of the coast, but no change in the depth of the soundings or character of the bottom could be discovered. There can, at the same time, remain no reasonable doubt that the exhibition was volcanic—probably a sudden emission of gas through an aperture or crevice not detected by the sounding-line.*

The extreme frequency of earthquakes in Assam would lead to the inference that it was the theatre of lively volcanic action. No fewer than twelve of these occurred betwixt May, 1834, and May, 1835. "About twenty years ago," says Dr. McCosh, writing in 1837—that is about 1817, "the natives inhabiting a small knoll near the hill of Golpara were so terrified by the unusual shaking of their little hill, that they fled from it for safety, and ran to a distance : on their return their houses and hill had disappeared, and a large pool of water, thirty or forty feet deep, occupied its place."†

The region of recent direct volcanic action seems, so far as we at present know, to terminate with the extremity of the Delta of the Ganges‡—a few hot springs are all we have to indicate the agency of subterranean fire for nearly 1000 miles across the Peninsula. There are hot springs in the Damoodah Valley, 23°10′ N., in Gangetic India, in Kunowar, in the Lower Himalayas, and near Lohunkund, on the Sutlej. The most notable of these is that at Sargunga, near Chota Nagpore, in Central India, where the temperature of the water is 184° : it smells strongly, and seems to be a Harrowgate. § Dr. Vosey describes a hot saline spring near Hyderabad, in the Dec-

* Three accounts of this most singular occurence are given with great minuteness in the Reports of Proceedings of the Bengal Asiatic Society for February 1845, p. 24—28, not indexed. The best account is that of Lieut. Hawkins.

† Topography of Assam, by Dr. McCosh. Calcutta, 1837.

‡ Col. Couseley, Bl. As. Trans., vol. xvii. p. i.

§ The following is from Capt. Baird Smith's memoir on Indian Earthquakes. I have not met in with the work of Dr. Falconer referred to as expected in 1843, nor, indeed, with any more recent account of the field of fire than about to be given : but from the frequency of our visits at Cashmere since 1846, I should suppose it must have been frequently since described.

"Whether recent travellers who have explored the valley of Cashmere have collected any further evidence as to the former condition of the province, I am unfortunately unable to say, as I have not yet been able to consult their works. That indications of active volcanic action are numerous and remarkable, I learn from Dr. Falconer, the latest of the Cashmerian travellers. He informs me that a singular 'field of fire' exists in the valley, of considerable di-

can.* In the Concan there are no fewer than twelve hot springs betwixt Dasgaum and South Rajpore, and they are supposed to follow the line of the great Ghaut chain southward to Ceylon: the majority occurs near the great lines of dislocation. There are two hot springs in Candeish, and several in Kattiawar, and Lower Scinde, as we shall presently see, abounds with them.

Lake Loonar, in the Sichal Hills, is the only instance of a volcanic outburst observable in this immense Plutonic region.† It is a nearly circular or oval depression in a country composed entirely of tabular and nodular basalt: it is 500 feet in depth and three or four miles in circumference. In the bottom of the hollow is a lake five feet deep, the waters of which are impregnated with muriate and sulphate of soda, and sulphate of lime; sub-carbonate of soda prevails in the neighbourhood. In 1851 it was examined by Dr. Bradley, who met with abundance of scoriæ in the neighbourhood, and was able to trace a vast stream of lava to the east and westward. The great intervals betwixt the points of volcanic activity in this part of India, even when connected by hot springs, prevents them from being associated as groups anywhere betwixt Arracan and Cutch.

On the 27th May, 1846, a hill on the Nerbudda, called Dumoh Phai, or smoking mountain, about 500 feet high above the plain, gave out alarming moans, to the terror of the neighbourhood, and then an enormous outburst in it occurred. The appearance this presented when examined shortly afterwards by Col. Skene and Lieut Briggs was such as might have been produced by the explosion of a mine, making a rent in

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mensions, and through crevices in which flames continually issue, the outlines of this volcanic tract are distinctly defined; and the action appears to be strictly local, the soil is completely burnt, and in some spots I believe, petrified. (vitrified?)—The igneous action has continued now for upwards of two centuries, as the existence of this remarkable spot is certified by Abul Fazil, the learned minister of the Emperor Akber* Mr. Moorcroft in his travels, (Vol. ii. p. 277) mentions a hill withen three days' journey of the city of Cashmere, from which loud explosions are heard at intervals, accompanied by the escape of gaseous matter, with force sufficient to tear off the doors and windous of buildings situated upon it. There was nothing on the hill resembling a crater, but the inhabitants on the spot asserted a distinct recollection of the explosions."—Bl. As. Trans. vol. xii, part ii. for 1843, p. 1046.

* For the above particulars, I am indebted to Dr. Falconer. They were given verbally, and are quoted from memory, so that they are rather indefinite; but as Dr Falconer's own account of the phenomenon may be expected erelong, it will be in my power to correct and enlarge the above notice.

* Second Report on Geology of Hyderabad.

† Malcolmson, London Geological Transactions, 1839. It was first described by Lieut. Alexander, in the Madras Literay Transactions, subsequently by Mr. Orlebar in the Bombay Geographical Transactions.

the hill from top to bottom about thirty feet across, and six feet deep. Great trees were upset by it, and the rocks rent twenty to thirty feet in pieces, as if blasted by gunpowder, and thrown to the opposite sides of the fissure. The appearance presented in no way resembled that of a land slip—the bursting force had obviously been from the interior. It was not stated that any erupted matter had been thrown out; there was no appearance of any volcanic vents in the neighbourhood, and no tradition of volcanoes ever having existed.*

In the end of October, 1849, something like an ebullition of pestilential gas, the discharge probably of a submarine volcano, occurred off Porebunder, in Kattiawar, and was manifest for thirty or forty miles out at sea: the fish were poisoned by it, and for days lay floating in myriads on the surface of the water. † An incident similar to this had occurred at Berampore, in May, 1810: the water in a large tank, usually pure, and which for a period of thirty-four years had never exhibited anything extraordinary, suddenly became of a dark green colour, and an immense quantity of fish, many of them weighing from eight to fourteen pounds, floated dead on the surface, and were afterwards removed in cart loads, and made use of as manure, the people ascribed it to an earthquake,‡ which then visited Calcutta.

There is no record of the Cutch volcanoes having ever been in a state of permanent activity, and they seem rather to have played the part of spiracles to the gases of earthquakes, when "the earth, seemed with a kind of cholic pinched and vexed," with fits of vomitting of lava or of flame. On the border of the chain of mountains, and eighteen miles from Lukput, the most westerly town in Cutch, is a hill believed by the Hindoos at one time to have been a volcano. It has long ceased to emit flame or smoke, but is still an object of worship amongst the Hindoos.§ It does not appear to exhibit any vestige of lava, scoriæ, or ashes; a bituminous earth, with a strong disagreeable odour, is dug out of the side of it, and used as incense in

* Bl. As. Trans. vol. xvi.

† See Report of 1850, B.G.S.

‡ Asiatic Annual Register, vol, xii. p. 465.

§ McMurdo's Account of the Province of Cutch. Bombay Lit. Trans. vol. ii., p. 210, 4to. edition.

the worship of Assapoora: it is found in small pieces imbedded in the common soil, from which it is separated without difficulty.

On the occurrence of the great earthquake shock of June, 1819, vast clouds of dust were seen to ascend from almost every hill or range of hills in Goozerat and Cutch; smoke was in many cases visible,* and some flame was perceived. At a place twenty-six miles west from Bhooj, fire was seen in considerable volume to burst forth; a blazing ball was projected into the air, and fell to the ground, where it was broken into four or five pieces, on which it became extinguished and invisible. No fragments could be discovered, but the vegetation was found scorched where it fell. On being examined next day, the hill was found rent and shattered, as if something within had sunk. Fire, to a certain extent, was said to have issued from a bituminous hill from which alum is made, near Murr: the height of the hill was considered to have been reduced, and it was rent and shattered into ravines. Near the town of Sinderee, situated where a branch of the Indus joins the Runn, and which was permanetly submerged on the occasion, a number of small cones, six or eight feet in height, burst up from the ground, and continued for many days to emit bubbles of air and mud from their summits.† The first and greatest shock occurred about seven p. m. on the 16th June: lesser shocks continued till the 20th, when the volcano called Denodur, about twenty miles N. W. of Bhooj, burst into action, and the movements of the earth immediately stopped.‡

Vestiges of recent outbursts, though of unknown date, appear at the village of Wagé-ke-Pudda. A high table land of volcanic matter,

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* Dr. Thomson, in his account of the Geology of Bombay, published in the Madras Literary Transactions, for 1837, after describing the hurricane and earthquake which occurred all along the coast on the 15th and 16th May, (the 26th and 27th new style, exactly 200 years to a day before the occurrence of similar events in 1848,) says:—"Besides the appearance of a violent commotion in the atmosphere, and a perceptible concussion in the earth, volcanic action seems to have occurred, if we may be allowed to deduce such an inference, from the highly embellished representations of the historian, of giants seen in the air throwing great globes of fire at each other; confusion of human voices in the atmosphere, the trampling of horses, and the sound of warlike instruments." It is added that much of this nature occurred in Salsette and other places. (Souza's Portuguese India, tome iii.) "The metaphorical figures", concludes Dr. Thomson, "expressed in the latter part of the description, are strikingly similar to those employed by Dion Cassuis in his account of the eruption which destroyed Herculaneum and Pompei, where we are told, giants were seen, and the sounds of trumpets heard in the vicinity." There is so little appearance of any recent volcanic eruption near Bombay that I should be disposed to ascribe the appearance, probably in both cases, to the meteorological phenomena always coincident with earthquake and volcanic action.

† McMurdo's account of the Earthquakes of Western India, 1819. Bombay Lit. Trans, vol. iii. p 105.

‡ Capt. Baird Smith on Indian Earthquakes. Bl. As. Trans. vol. xii. June, 1843. The authority on which this statement is made is not stated.

about two miles square, has been blown out into a flat basin, the sides being broken into fissures, with craters, ravines, and hollows; and the interior, or bed of the basin, interspersed with hillocks and cones of every variety of colour—black, red, yellow, and white, and with patches of cinders similar to the refuse of a furnace—the whole looking as fresh as if the igneous agents were still in operation. The surface of the table land immediately surrounding the blown out space is covered with burnt iron-stone, similar to septaria, divided into irregular cells. On other parts of the table land, craters of some fifteen or twenty feet in depth have been blown out: they are composed of the materials just described, and are covered with patches of sulphur.*

The rocks around the hot springs of Peer Muggen, ten miles west of Kurrachee, consist of nummulite limestone, in some cases highly crystallised, and where the fossils, according to Captain Viccary, occasionally are extensively altered. Two miles further to the westward, occurs the group of Minora hills, about 800 feet above the sea, and 500 above the plain surrounding. On the eastern side a crater has been blown out,—the ruins are scattered around. It is oval in form, about 150 feet in length, and fifty across. The explosion has burst away one of the sides, and blown through the strata adjoining. It seems as if a vast deluge of water had for a short time been discharged from it; there is no tradition † in existence regarding it, nor is anything known of the date when it was in action. It has clearly been subject to the great changes which have taken place around, though it is probable it preceded the deposit of the post pliocene clays found at its base, ‡ as these bear no appearance of disturbence, and have most likely been deposited by the sea subsequent to the explosion. There are several other craters of lesser size and more imperfect structure round Minora. The rocks at the Lukkee Pass—hotsprings appear to

* Grant's Geology of Cutch, London Geol. Trans. 1838, p. 316.

† Capt. Carless, who gives (1838) by far the best account of this district yet published, speaks of a celebrated hill called Jibel Pubb, twenty miles N. W. of the hot springs, of which wonderful stories are related all over the country, but he does not tell us what these stories are.

‡ Capt. Viccary describes the clays as post pliocene. He makes no mention of the crater. I visited it and took careful drawings and measurements of it in March, 1850. The highly crystalline state of the rock is conspicuous. I confess I could discover no evidence of any material diminution of its fossils around the springs or near the crater. The rocks, which everywhere around are one mass of shells and zoophytes, the corals being often in the most beautifully perfect state that can be imagined, have been in some places highly crystallised, the organic remains being in part obliterated. The crystals are occasionally arranged in beautiful star-like forms, like many members of the zeolite family.

be of exactly the same description as those at Peer Muggen—their position in all likelihood due to volcanic influences of comparatively recent existence. The hot springs of Peer Muggen attain a temperature of from 100 to 150, and yield a very copious discharge. The water is perfectly pure, and fertilises the soil around.* One of the tanks contains nearly 200 crocodiles; there is a spring at no great distance, which affords large deposits of sea salt.

The next volcanic group to be met with in this direction is that of Hinglaj—a series of mud volcanoes, very similar in point of form to those of Chedooba, along the sea board of Lus, and now in great activity. Here there is no appearance whatever of there ever having been any eruption of lava. The first of these are called the koops of Chundra. They are believed to be of Divine origin, and to be possessed of miraculous virtues.

"Within two days' sail of the port of Kurrachee, within a hundred yards of the sea, commences the group of mud volcanoes known by the name of the Koops of Rajah Rama Chandra. Three of these were visited by Captain Hart; a fourth was seen by him at a distance; and they are said to be very numerous, and to extend some way along the shore, and far into the interior. About two miles from the wells of Tilook Pooree, three hills, of extremely light-coloured earth, rise abruptly from the plain.†

"The centre hill is conical, slightly flattened, and divided at the top: it is about 400 feet high: its southern and western sides are more precipitous than the others. The second of the group is about half the height of the first; the two are connected by a causeway about fifty yards in length. The third covers a greater area than either: its apex seems destroyed or broken off, otherwise the characteristics of the three closely resemble each other. They are all indented at the base with numerous chasms and fissures, which run into the interior; and their sides are stroked from the summit down as if with sluices of mud or water overflowing from the crater. A basin of liquid mud about thirty yards in diameter occupies the whole summit of the largest of

* The hot spring takes its name from Peer Muggen a Mahomedan Saint, whose shrine is close by. The coincidence of the sound with the designation given to the long-snouted crocodile (muggur) has led to the inference that it was Peer Muggru, the Crocodile Saint. The crocodiles in the tank are of the kind called Gavial: they are precisely similar to those of the Nile and Ganges.

† Extracted fr om the Reports of the Society for May, 1850.

the three. Air bubbles and jets of mud arise from the basin continually —the semi-fluid mass within being constantly disturbed by them. The whole summit of the hill is crusted over with caked mud. The same appearances almost exactly are presented by the craters of the two other hills,—with this difference, that in the case of one of them the mud was said to rise and fall, occasionally overflowing the crater, sometimes sinking in it above 15 feet. A fourth hill, similar to those just described, was seen at some six miles off, but was not visited. The water and mud all around is salt. The ground at the base of the hills is full of cracks and rents. It is the same volcanic agency, most probably, which gives rise to the hot springs of Peer Muggen, that supply the famous crocodile tank, which feeds or stimulates the mud volcanoes. Abundance of brimstone is found at no great distance, and one eminence some twelve miles off is known by the name of the sulphur mountain." Capt. Robertson describes the whole district, for an area of probably not less than 1000 square miles, from the Hara range westward as covered with mud cones, active or quiescent. He spent a fortnight amongst them in 1849, and could discover no particular day on which they were unusually affected: Captain Hart had been told that on Monday they were more active than they were on other days. "The native tradition regarding them is, that the abduction of the Goddess Seeta by Rawun Sedashew, a form of Mahadeo was amongst others occupied in endeavouring to discover the place of her concealment. For twelve years he prosecuted his search unceasingly, but without effect. Worn out with exertion, and enraged at the fruitlessness of the task he had imposed on himself, he dashed his sacred cake on the ground. It broke into eighteen pieces, and from every fragment a koop arose. The goddess instantly appeared, and chid his wrath and impieties, assuring him that throughout his wanderings she had accompanied him in the shape of a fly, which generally sat on his holy cake. In commemoration of his exertions on her behalf, she ordered that every pilgrim should pay his devotions to one of the koops before visiting her temple. The koops are called by the name of her husband Rama Chandra. On nearing the crater, the holy man who precedes the pilgrims continually cries out, Speak, oh! Rama Chandra!—and to their astonishment, accordingly;

they find on their arrival the mud at the top in a state of commotion,—evidence to them sufficient that the invocation has been listened to, and the deity is present."*

Turning back on the Indus, we find hot springs in the Lukkee Pass. The range of hills in this neighbourhood is composed of little ridges not exceeding 400 feet above the plain of the Indus, their apices with nearly horizontal strata, their sides abrupt and precipitous, and non-nummulitic. The valleys, or intervening spaces between the hills, have been much disturbed. A variegated clay, abounding with gypsum, but containing no fossils, is of common occurrence. A brown, rust-coloured rock is abundantly distributed on the surface in the shape of rounded boulders, the most promising specimens of which are manufactured by the natives at Kotree into iron. Between this and the Indus are numerous low hillocks of alumniferous clay, used for the manufacture of alum by the Scindees. The hot springs issue from the bottom, from what appears an external crater, of the same general character as those already described near Peer Muggen. There are here several hot springs near each other—they are all salt and sulphureous; the whole valley smells strongly of sulphuretted hydrogen gas, which rises in bubbles from the well, and a scum is constantly gathering on the water, which the natives remove and use as sulphur. Near one of the hot springs is an aperture in the rock three inches in diameter, from which, until of late years, a jet of flame used to issue ; it was called the peri's fire by the natives, and is believed to have become extinguished on some infidel having bathed in the neighbouring well.†

There is a very copious hot and sulphurous spring at *Gurrum-ab*, (*i. e.* hot well, spelt gurruma, Col. Campbell's map). In the Bolan Pass, about 200 miles to the northward. I am not aware of any between this and Lukhee.

The area of the volcanic field of Beila has never been precisely determined: it extends some fifty or sixty miles inland, and at least three times as much along shore.

* Abridged from Capt. V. Hart's Pilgrimage to Hinglaj, Bom. Reports 1850, p. cviii. A much more minute and copious account of Hinglaj than that given by Capt. Hart is published in the 15th vol. of the Bom. Br. of the Roy. As. Soc. for 1850 written by Capt. Hart: it confirms the perfect accuracy of Capt. Hart's account, as far as it goes.

† Abridged and slightly altered from Capt. Vicary's account. London Geol. Trans. 1846, vol. iii. p. 341.

The band, if band it be, now trends away southerly, from lat. 22° to lat. 12°, and the next group we meet in with, after a break of above 1000 miles, is that at the mouth and at the lower part of the Red Sea, commencing with Cape Aden, and concluding with Gibbel Teir, extending across from the former of these to the Salt Lake Assal, inland from Tadjoura, and so on towards Shoa.*

Aden is spoken of by Arab writers as having been in a state of activity within the historic period, and though there scarcely seems evidence sufficient of this to be relied on, and a very strong presumption to the contrary, it has all the *appearance* of great recency.

The volcano forms the terminal point of Southern Arabia, where the shore, after having inclined gently southward from Ras-el-Hudd, 21° N. Lat., at the entrance of the Persian Gulf to 12°, stretches almost due west, till it turns up the Red Sea. At no great distance of time it has obviously been an island, and is now connected with the mainland by a low sandy spit four miles long and half a mile across, only a few feet above high water mark: the whole shore indeed, consists of sandy downs or salt swamps, only a little above the level, of the sea, and wearing the aspect of recent emergence. The peninsula itself is an irregular oval, five miles in its greater, and three in its lesser diameter. There are numerous little head-lands with sandy bays between, all around it. There is at the head of each little bay, and on several points of the shore besides, a level expanse of rolled gravel and sea shells, evidently an old sea margin, brought to light by the same up-heaval that converted the island into a peninsula, and raised the isthmus above the level of the sea. The rocks themselves are all lavas of various descriptions, more or less vesicular, and the volcano affords a vast diversity of igneous minerals. There seem to have been from time to time a number of craters in the mountain, one of very considerable magnitude beyond the coal depôt betwixt Ras Morbut and Ras Tar Shagan, having been blown outwards, and now remaining as a valley ascending from the sea. The edge of the principal crater is near the centre of the Peninsula. The crater itself occupies the eastern half. It is exceedingly well defined indeed, and at once indicates its origin to the spectator. It is about one and half a mile in diameter, and

* See Dr. Bird's Notes to Capt. Foster's Account of Cape Aden. Bombay Geographical Trans. 1842. Referred to in Report of the Society for 1850. vol. ix.

is nearly circular, affording a circuit of five miles. Of this half a mile has been blown out right down to the level of the sea. The bottom of the crater on which stands the town of Aden and the British Cantonments, is covered with a bed of rolled gravel and sea shells, proving that there has been no trace of eruption since the last general upheaval, which produced the sea beach all along these shores, but which is still believed to have been within the human, perhaps even the historic, period.* The Shum-Shum range, which forms about half the wall of the crater, reaches an altitude of above 1760 feet. There is a huge crack or slip which cuts above a third off the eastern side of the volcano, and through a portion of this, constituting a narrow gorge or pass, ten feet wide, and twenty or thirty high, the road from Steamer Point enters the crater, and leads to the cantonments. Dr. J. P. Malcolmson supposes this to have been the remains of the latest great eruption of which the effects are chiefly manifest on the table land on the eastern buttress of Shum-Shum : by this the ancient crater was shattered nearly through its centre from the northern to the southern pass, breaking into pieces, and separating the whole of the eastern side of the edge of which Seera Island is a fragment,—and in these views I concur. (Lond. As. Trans. 1846.) On the one side of this which remains the wall of the crater subsides from 1700 to 600 feet, and then breaks away altogether. The rift probably occurred when the side of the crater was blown out and demolished. The walls of the crater as now existing, when seen from the cantonments, present the most magnificent view that can be imagined : one semi-circular precipice, five miles in circuit, ascends some 1776 feet from the plain. It is in most places perpendicular. The cliff is of a rusty dark brown colour, and full of caverns and recesses, carved almost like the alter screen of a Gothic cathedral. Great streams of lava may be observed from point to point, as if the fiery cataract had been arrested in its progress, and congealed as it flowed from the lesser rents of the principal crater. On many parts of the rock, 500 feet above the level of the sea,—to the level of Shum Shum so far as I know, but the altitude just named is all to which I have examined,—great masses of volcanic ashes are strewed

* See Report of the Society of Civil Engineer's May 20, 1851, copied into "*Bombay Times*," July 9. Also Miss Fanny Corbeaux's letters. *Athenæum* June 28, and July 5, 1851.

amongst the crevices of the rocks, these generally abounding, as does the surface all around, with sea shells in a state of great decay, to all appearance borne up by the volcano on its last emergence from the deep.

The minerals found at Aden are very numerous. We have almost every variety of lava, compact, earthly, vesicular, amygdaloidal porphyretic, and obsidian in all its forms, from dull coarse green and blnish green to beautiful jet black. Pumice is found, but is not plentiful. It is mostly of a c[illegible] reddish brown colour, and is heavier and more coarse in its texture than the mineral of commerce, and less suited for the finer purposes of the polisher. Brimstone is sometimes found, but rarely. Rock crystals in veins, nests, and crusts, are very plentiful everywhere. In many parts of the volcano chalcedony in various forms abounds, in some cases it appears in [illegible] crusts, in button-shaped encrustations in drops or studs, occasionally covered over with delicate rock crystals. These are of a beautiful bluish white, and take a prominent place in any cabinet. On these are occasionally found small crystals of purple fluor spar, from the size of a mustard seed to that of a pea, and carnelians, as a thin crystallised veined variety of calcedony is called, of various tints of brown, exactly like the Rozo marble seen at Malta, are portions of the Rock of Gibraltar from which ornaments are cut. Sulphate of lime is found in veins in the form of beautiful fibrous gypsum, semi-transparent and colourless, it also occurs in plates. Specimens of all the minerals here described I have in abundance in my own cabinet—they have been mostly collected for me by Dr. Malcolmson, Mr. Mayes, and Mr. Adie, the duration of my visits to Aden precluding me from procuring the rarer minerals.* Right across the bay to the eastward, as a distinguishing [illegible] the magnificent remains of another crater, called [illegible] It is nearly the same size and form as Aden, but [illegible]

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following authors have been consulted in preparing this article. Travels of the Bible, by the Rev. Dr. W. Lees, Peninsula, Shores, and Climate of London Geog. Journal. Travels. Medical Topography of Bombay The Journal of the Geol. Trans. p. 866. Ucers, Dr. Carter. Journal Phy science. Fraser, Bombay Engineers. 339. Description of, by Rev Dr. Duff. Bombay Times, 1840. p. 167. Wignen, Lieut. Fraser's account of. Lond. Geol. Trans. [illegible] Ind. Rev, vol. 6, 1843, Malcolmson.

mainland. The centre peak attains an altitude of 1237, feet, and on sailing round in certain aspects it presents the appearance of a stupendous Gothic cathedral; two peaks of 700 feet, close beside each other, have obtanied the very unpicturesque name of the Asses' Ears, from the appearance presented by them far out at sea: seven miles beyond this, and seventeen from Aden, another fragment of a cone of smaller size, but considerable beauty, rises up to the altitude of 700 feet and projects about three miles into the sea, while halfway betwixt this and the straits, Gibbel Kurruz or St. Antoney, apparently a volcano, reaches an elevation of 1772 feet—Barren Peak and the high range of Gibbel Arrar, or the Chimney Peaks, just opposite the strait, being all set down by the surveyors as hills of volcanic origin.* The range from this bends northward, and follows the line of the Red Sea shore.

From Aden to Babelmandeb, indeed the rocks along the Arabian shore seem to be wholly volcanic for a distance of above 100 miles. On the African shore a singular cove at the upper end of the Bay of Tadjoura, called Joobul Khareb, seems the crater of an old volcano; it is connected with the Bay of Tadjoura by two narrow channels the whole width across from coast to coast being about three quarters of a mile, with a small island near the middle. One of the channels is forty yards wide, with sixteen fathoms water, the other 250, with three fathoms. The cove inside is about thirteen miles in diameter, by six—the western portion is volcanic. At its extremity is a basin, or crater, 300 yards in diameter, surrounded by precipitous volcanic cliffs through which the sea makes its way to the water inside, the entrance is dry at low water. Lava and scoriae abound everywhere around.† The waters of the cove are said occasionally to be violently agitated and disturbed without apparent cause, probably by the emission of gas from

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Trans. Ancient Inscription found at. See Haines. Accoun of Quicksilver found at.—*Bombay Times*, 1843. Dr. Arbuckle's Report on Bombay Geo. Trans vol. i, page 302. Lieut. Wellsted's Memoir on the coast N. of page 19. Aden, M. D' bbae's account of, p. 12. Buist. Dr., on specimens of lava from—Bombay as Trans. vol. i, p. 345. Size of, compared with Ætna Remarkable currents in Gulf of, be wi t the Arabian African shores, Haines on. Lon. Geog. Trans. 1818.—Supposed to arise from the influence of the winds. or variation in the character of the water in the Red Sea. Discovery of Fluor Spar in lava of, Dr. Giraud on.

* The whole of this information is taken from the Charts and Survey Notices of 1836—40 Aden is the only volcano I have myself examined—the others I have merely seen from sea. They have all the appearance of being correctly described, and considering the ability of the surveyors, I have no doubt that they are so

† Capt. Barker's paper. Lond. Royal Geograph, Trans. 1848.

below,* the volcano being scarcely yet asleep. Off the outer bay the hills are of limestone, and rise to the height of 2000 feet.

The rocks around the salt lake Assal, whose waters are now nearly dried up and encrusted with salt, are all volcanic on the eastern side. A bed of lava, containing several deep fissures, separates the waters of the lake from those at Gubat el Kherab, of which it appears to have been a continuation.† The lake is 11° 38′ 12″ N., and 42° 30′ 6″ E.; it is about seven miles across in its larger diameter, and 570 feet *below* the level of the sea. For about 300 miles westward into the interior the whole country seems volcanic. To the south-westward of this, near Shoa, is the volcano of Gibbel Abida, about 4000 feet high, its crater opening to the N. W., and about two and half miles in diameter, and further on the still higher peak of Aiullo. Here there is an even plain about thirty miles in diameter, studded with small cones, of which as many as twenty may be counted at once, each exhibiting a distinct and well formed crater. The lava every where around is fresh and glossy but no tradition exists of any eruption having occurred within the memory of man.

Returning to the Straits of Babelmandeb, we find the volcanic peaks of the High Brothers, just outside the gut, on the African shores. The Island of Perim, which occupies a portion of the Strait near the Arabian side, with the Babelmandeb Peak on the mainland close by, are masses of lava. Along the African shore, from lat. 11° to lat. 14°, and from long. 42° to Long 44° the series of volcanoes is uninterrupted for the space of 400 miles running into the interior about 10° N. towards Ankobar, long 40° E.‡ How far the volcanic district extends into the interior along the African shore within the Straits of Babelmandeb does not appear—a range of hills above fourteen miles from the sea. to which it is nearly parallel is set down on the chart as mostly volcanic: there is a second chain of very high mountains parallel to this again, about fifty miles further to the west, but its character does not appear to have been ascertained. On the Arabian shore, from lat. 13°

* Harris' Highlands of Ethiopia, vol. i. p 17.

† Dr Kirk's Journey from Tadjoura to Ankobar, 1841. Royal Geogrl. Trans. 1841, vol. x. The paragraph is given verbatim. Ibid, and more extended, Bombay Geogrl. Trans. vol. vi., 1841 to 1844.

‡ Dr Kirk, ut sup.

to lat. 15° 40′, for a distance of nearly 200 miles, a range of hills of volcanic origin is set down on the map about twenty miles from the shore, with a second range behind them, like that on the African side undescribed. The lower range is a continuation of the Aden volcanoes; this extending in a continuous line for above 300 miles along shore. There can be no reasonable doubt that the whole basin of the Red Sea,—here about 100 miles across,—from the Arabian to the African chain of peaks, is volcanic, studded as the intermediate channel is with cones now in a state of activity, so that the ascertained area of this region from Aden to near Ankobar, from this to Gibbel Teir is about 350 from E. to W., and 450 from S. to N. Within the channel of the Red Sea the most conspicuous peaks are the Harnish Islands, and Gibbel Googur, betwixt lat. 13° 40′ and 14°, the Zebeyar Islands in lat 15°, and Gibbel Teir in lat 15° 30′. A violent eruption of short continuance occurred in the Zebeyar Islands on the 6th August 1846. Gibbel Teir has for nearly a century been known to be in a state of constant activity. It was visited by Bruce in 1774; it then gave out smoke, and was said occasionally to emit flame and stones; he describes the masses of lava as having shells embedded in them, a circumstance that has not, so far as I have observed, been noticed by any other traveller.* It was visited by Capt. Elman when engaged in survey in 1838,† and by Dr. Kirk in 1841. The island is circular about seven and half miles round,‡ resembling, on being approached, a hill of considerable elevation rising from a plain terminating in a bluff steep on the eastern extremity. The summit of the hill is about 300 feet above the sea level,—there are no soundings close in shore, at 150 fathoms, so that the visible portion is merely the summit of a hill the base of which is hid by the water in all probability 1,109 feet high, or 1,900, if the altitude of 900 assigned it by the chart be correct. The whole surface is covered with ashes, lava, and cinders; near the summit there are about fifteen small open craters, from several of which steam and hot air are continually issuing, and occasionally smoke. Streams of indurated lava are seen to proceed from these chiefly towards the east side of the island. It is said to have been on fire about 1828 or 1830. One

* See Travels, Quoted in Geographical Society's Report for 1850.

† I have taken Dr. Kirk's description, slightly abridged.

‡ Dr. Kirk makes 300, Bruce 500; in the survey chart it is set down at 900.

of the peaks in which it terminates exhibits the remains of two craters of about twenty five feet in diameter—both have fallen in. A single crater of much more recent formation than the others appears in the Northern peak of Gibbel Teir; it seems the northernmost of the volcanoes in the Red Sea, and probably limits the band.

We have no information whatever, so far as I know, as to any volcanoes in the interior of Arabia, or to the Northward. An extinct volcano, called Mount Nimrod, is described by Mr. Chancourtois* as existing near the Salt Lake Van in Armenistan, on the frontiers of Persia, between the 38th and 39th degrees of latitude. On the banks of the Euphrates, near the city of Hit, in the region of the Petroleum Wells, Dr. Winchester found scoriæ on the summit of a detached hill about eighty feet above the level of the plain; no other volcanic appearance was observed.†

The following, on the supposed burying of great cities in Central India, is extracted from the 8vo edition of "Lyell's Principles of Geology, 1832"—it is transferred unaltered to the edition of 1851:—

"We remarked in a former volume, that in many countries which have been peopled from remote ages by civilized nations, and have been at the same time the theatres of volcanic action, there must be innumerable monuments of the highest value to the historian, which continue unobserved 'because they have not been searched for.' But we omitted to describe in detail a splendid example of several buried cities in Central India, which might probably be made to yield a richer harvest to the antiquary than Pompeii and Herculaneum ‡ The city of Oujein (or Oojain) was, about fifty years before the Christian æra, the seat of empire, of art, and of learning, but in the time of the Rajah Vicramaditya, it was overwhelmed, together, as tradition reports, with more than eighty other large towns in the provinces of Malwa and Bagur, 'by a shower of earth.' The city which now bears the name is situated a mile to the southward of the ancient town. On digging on the spot where the latter is supposed to have stood, to the depth of fifteen or eighteen feet, there are frequently discovered, says Mr. Hunter, entire brick walls, pillars of stone, and pieces of wood of an extraordinary hardness, besides utensils of various kinds, and ancient coins. Many coins are also found in the channels cut by the periodical rains, or in the beds of torrents into which they have been washed. 'During our stay at Oujein, a large quantity of wheat was found by a man digging for bricks. It was, as might have been expected, a most entirely consumed, and in a state resembling charcoal. In a ravine cut by the rains, from which several stone pillars had been dug, I saw a space from twelve to fifteen feet long and seven or eight high, composed of earthen vessels, broken and closely compacted together.' It was conjectured, with

* Report of the Academy of Sciences 17 Nov. 1845.—Ibid Edinburgh Philosophical Journal April 1846, p. 377.
† Bombay Geographical Transaction, vol. ii. p. 30.
‡ Ibid, p. 407.

great appearance of probability, to have been a potter's kiln. Between this place and the new town is a hollow, in which, tradition says, the river Sipparah formerly ran. It changed its course at the time the city was buried, and now runs to the westward*.' The soil which covers Oujein is described as 'being of an ash-grey colour, with minute specks of black sand†.'

"That the 'shower of earth' which is reported to have 'fallen from heaven,' was produced by a volcanic eruption, we cannot doubt, although no information has been obtained respecting the site of the vent; and the nearest volcano of which we read, is that which was in eruption during the Cutch earthquake in 1819, at the distance of about thirty miles from Bhooj, the capital of Cutch, and at least three hundred geographical miles from Oujein.

"Captain F. Dangerfield, who accompanied Sir John Malcolm in his late expedition into Central India, states that the river Nerbuddah, in Malwa, has its channel excavated through columnar basalt, on which rest beds of marl impregnated with salt. The upper of these beds is of a light colour, and from thirty to forty feet thick, and rests horizontally on the lower bed, which is of a reddish colour. Both appear from the description to be tuffs composed of the materials of volcanic ejections, and forming a covering from sixty to seventy feet deep overlying the basalt, which seems to resemble some of the currents of prismatic lava in Auvergne and the Vivarais. Near the middle of this tufaceous mass, and therefore at the depth of thirty feet or more from the surface, just where the two beds of tuff meet, Captain Dangerfield was shown, near the city of Mhysir, buried bricks and large earthen vessels, said to have belonged to the ancient city of Mhysir, destroyed by the catastrophe of Oujein." ‡ —*Lyell's Principles of Geology*, 1832. pp. 237-38.

I have not had it in my power to visit or examine this part of India, and can only speak of it on the authority of others. I am from this strongly inclined to believe, that the tradition of the shower of earth is wholely fanciful, and that the assumption of the submergence of the cities in Central India wants confirmation. It is quite clear from the expressions made use of, that both Capt. Dangerfield and Sir John Malcolm speak mainly on the authority of Mr. Hunter: the latter writes with the utmost hesitation, and both at best are but hearsay witnesses.

The following are the words of Captain Dangerfield in reference to Mhysir, from which it will be at once seen that he believed the earthy mass on the banks of the Nerbudda Alluvial, not volcanic.

"At present there is no appearance of volcanic matters, though some of the hills, both in the Vindhya range and in the neighbouring wild tract of Rajpeeply, are said to have hollows sometimes filled with water, near their summits, which have been thought to resemble extinct craters. These I have never seen, and cannot, therefore, hazard an opinion. Earthquakes appear to be, to the North-west, of frequent occurrence; and, if we may judge from the recent one which nearly overwhelmed the province of Cutch, often very severe. These soils are sandy, and with their saline ingredients appear, however, naturally enough to be derived from the decomposition of the rocks composing the neighbouring mountains,

* Narrative of a Journey from Agra to Oujein, Asiatic Researches, vol. vi. p. 36.
† Asiatic Journal, vol. ix. p. 35.
‡ Sir. J. Malcolm's Cent. Ind.—Geol. of Malwa, by Captain F. Dangerfield, App. No. ii pp. 324, 325.

and which each rainy season, with the violence peculiar to India, would bring down and deposit in great abundance. But how the two strata have acquired their relative position and marked line of separation, it is here unnecessary to surmise or inquire."—*App., No. II., to Sir J. Malcolm's Memoir of Central India.* p. 325.

Conolly, on the other hand, speaks from careful and minute personal observation, he being one of the most exact and observant writers of his time. There are others who write to exactly the same effect with Conolly, though I am not at present able to cite them. It is a sad reproach to our government that with such abundance of men of talent and research at their disposal, facts so interesting and important as these should remain in dubiety: even the Neapolitan government charges itself with the investigation of the antiquities of Herculaneum and Pompeii.

"The theories which account for the change of site of *Oujein* appear to me al equally unsatisfactory—I neither believe with HUNTER that a shower of earth nor with MALCOLM that a flood, overwhelmed the old city, nor with the natives that it was turned topsy turvy. The tales of old bricks, and of wood of surprising hardness, &c. dug up at depths of fifteen feet seem to smack of the *Oujein* failing of exaggeration. Several people were interrogated who had been twenty and thirty years at the place, none of them had ever positively seen such things though all believed most religiously both these and much more wonderful curiosities to be found. It is currently told, that a chamber was discovered in which was seated the skin of a beautiful lady, just, explained my informant, like the shape of a grasshopper which you see trembling on a stalk of grass in the dry weather. Some incautious visiter approached too near the delicate shell, it vanished into air —like the fish found in the pyramids,—'comme de la pousière qui s'envole quand au souffle dessus.' Bricks found at any depth would prove little, for they might have belonged to walls which stood on the slope of a hollow, filled up by time; many of the houses of the present town being built in this fashion to save the trouble of making a back wall, or they might have belonged to under ground granaries tahkhánehs, or wells. A shower not exactly like the famed one of bricks and tiles,* but one equally composed of building materials, such as rained, says ASSEMANI, in 769, 'Une pluie de pierres noires,' seems as likely to have fallen here, as earth or sand.

"The surface of the hill (of the old city) where it has not been ploughed and picked is strewed with fragments of stone, just as you would expect in a place which had once been covered with houses: these broken pieces of trap being parts of walls of which the larger companions have been taken away as material for other buildings.

"The theory of an inundation is principally supported by a tradition that the river has changed its bed. This belief seems to me a native fabrication to account for a square, tall, brick building, which resembles the wells so frequently found near the banks of the river. It is situated in a hollow, through which the River is said formerly to have flowed, and which is perhaps merely the dried up channel of some Nullah. Of the name of the well *Bibi Mako* I could get no more satisfactory explanation than that the words are convenient for the repetition of the echo. Every little idle urchin runs into the square and bawls out *Bibi Mako* with a drawl on the o, and is equally

* PLINY, where the date is gravely given.

frightened and delighted with the reply of *Bibí Mako*. One argument is conclusive against an inundation: that the hills on which stood the old city are higher ground than the level of the present town, and that the latter is the more likely also to be overflowed. Indeed no such extravagant theories are required to account for the desertions of the first occupied spot. The whim of the reigning prince is sufficient to determine the position of any oriental town, of which we cannot look around without observing instances, as at *Delhi*, *Lucknow*, *Maheswar*, &c. And that coins and antiques should be picked up, is not a whit more extraordinary than the annual harvest of such curiosities at *Beghram* and *Canouj*, &c. towns, the last of which at least, was gradua ly deserted.

"Romance lovers would be shocked at my theory of the origins of the so-called rája BRISTRI'S caves. The natives are in the habit of excavating the foot of the hills of the old city for an excellent clay of which there is a thick and extensive bed. Any one who has resided at *Delhi* will remember the excavations there for the same purpose, which have not unfrequently been converted into agreeable tahkánehs. One of those at *Oujein* nearly rivals in extent BHIRTRI'S retreat, is supported by arches cut out of the clay and is divided into several chambers. Such was probably the origin of the great caves, which are very low, and not of any great extent.* They are supported by pillars, clumsy, but massive, and the walls and ceilings are lined with enormous blocks of stone calculated, it might be thought, "to fatigue time." But they will shortly be crushed by their own weight; already one room has fallen in, and some of the slabs are in such a position that at first sight it does not seem safe to walk under them. What may have been the primary object of the buildings is matter of question. The natives contend that it was rája BHIRTRI'S hermitage, but their own fables refute them, for we read that the rája immediately after swallowing the *amar phal* set out on his travels. In no place did he allow his weary limbs long to rest, though he halted at *Sehwan* on the Indus, at *Bhartewar* near *Khyrpda*, at *Chunar* and *Benares*, and to this day he is believed to be still wandering about, among the *Hyperboreans* beyond the *Himálayas*. A late writer† imagines it to have been the dwelling place of rája BHIRTRI'. There is, however, no appearance of its having been built to live in. BHIRTRI' would have run the risk of breaking his head or his shins. every time he rose up, or walked, in his low roofed unevenly-floored mansion.‡ The pillars too are sculptured on only three sides, that side which faces the wall, and which would not be seen by one passing through the caves, not having been even smoothly chiselled.

"The antiquity of the caves will be much lessened,§ if from the first they were furnished in the same fashion as the present, for they are now evidently ling temples. The figures on the pillars, are small, much defaced, and were originally far from being deeply carved, but there is no difficulty in recognizing them for those indecent groups which mark the temple of *Shiva*. Several lings are scattered about, though one only seems to be worshipped a *Kedareswar*, 'lord of cedars.' Marks of feet engraved on the rock are not unfrequent. At the end of the left cave on a slab of black stone about three feet high and one broad, two figures (one over the other), are cut, sitting cross-legged, performing tapasya. The upper one is called *Gorakhnáth*, the lower, his pupil *Bhirtrí*.

"Near the entrance lies a huge head of a *Rákshasa*, and the ghát below takes

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* The dimensions may be seen in HUNTER.

† The author of the paper before alluded to in the E. I. United Service Journal.

‡ The caves seem by their position to be exposed to inundation, which alone would have unfitted them for houses, and may have been the cause of their having been solidly built. An outer court, though very strongly constructed has been partly thrown down apparently by the swell of the river.

§ That is according to COLEBROOKE'S theory, which however seems to have now but few followers.

its name from a gigantic stone image of *Kapilá muni*, which leans against the bank half buried in sand.

"The quantity of antiques collected amongst the ruins of Indian cities has always seemed to me a subject of wonder. The supply from the old *Oujein* is so constant and plentiful that the natives call the place by the appropriate name of *Rozgár ká Sadábírt*, and it is in truth a never failing charity for the industrious poor. In the idle days of the rains the digging begins. The principal things found are glass, stone, and wooden, beads, small jewels of little value, seals, (agate and cornelian,) and a few women's ornaments; copper coins are numerous, next in number are the debased silver *Guzeráti* ones. Pure silver rupees seem scarce, and gold mohurs are either secreted and melted when found, or they but rarely reward the searcher, for I was only able to procure one, and that a doubtful specimen. As the pilgrims carry away with them, as relics, what has been dug out of the *Juné-garh*, the merchants mix with the real antiques every old bead or piece of copper which has an ancient look, and pass them off as genuine on the unsuspicious natives. One man brought me a large heap of copper seals or plates of chapásses which had engraved on them modern Musalman and Mahratta names, and was ready to take his oath that they had been dug up, which perhaps they were, for he had probably buried them that they might have the appearance at least of age. Steatite '*Nádáls*' are also frequently brought for sale, some of them as old-looking as if they had really been buried with the city."—*Journal of the Asiatic Society of Bengal.* pp. 851-54.

ART. IV.—*Geology of Bombay.* By DR. BUIST.

*Description of the Island.**—The Island of Bombay is one of a multitude on the North-Western shore of Hindoostan, which varying from a few yards to above a hundred square miles in area, fringe the

* It is somewhat singular that there should so lately, have been so much uncertainty about the position of Bombay. In the Anniversary Address to the Royal Geographical Society, in 1843, Mr. Hamilton stated that the longitude of Suez had been set down by Captains Carless and Moresby at 32° 30′, this being on the assumption that Bombay was 72° 57′ 40″ E. as given by Horsburgh, but that Mr. Goldingham had subsequently made Bombay 72° 54′ 36″, from Lunar and Satellite observations. Captain Thuillier gives the following latitudes and longitudes of various points in Bombay from the records of the Trigonometrical Survey, and this these appear to have been determined by Captain Jacob before 1840 :—

	Lat. North. ° ′ ″	*Long. East.* ° ′ ″
Observatory	18 53 45	72 51 14
Lighthouse	18 53 40	72 51 10
St. Thomas's Cathedral	18 55 50	72 52 30
Byculla Church	18 58 5	72 52 23
Butcher's Island Tower	18 57 31	72 56 41

We have the following longitudes and latitudes for Bombay, meaning in general the Observatory or the light house :—

	Long.	*Lat.*
Horsburgh, 1817	72°57′40″	18°53′45″
Goldingham	72°54′36″	18°54′27″
Cogan's Chart	72°54′24″	18°55′42″
Captain Shortrede, Trig. Survey	72°51′15·6″	
Captain Jacob, Trig. Survey. 1840	72°51′14″	
Mr. Orlebar, Obs. Report 1845	72°52′30″	
Ditto ditto 1846	72°49′45″	

Malabar Coast from Lat. 9° to Lat. 20° N., on a narrow examination seeming like fragments broken from the mainland during the many upheavals and depressions to which it has from time to time been subjected; several of these movements having obviously occurred at a comparatively recent period, geologically considered.

2.—The Bombay Group, between Lat. 19°, and 20° consists of fifteen or twenty Islands in all; 1, the Island of Bassein, about thirty miles to the northward of that which gives the cluster its name; 2, of Dravee; and 3, of Versova, just off the shores of Salsette; 4, of Salsette, by much the largest of them all; 5, Trombay, conspicuous for the mountain called Neat's Tongue, from the singular resemblance it bears to the tongue of an Ox, and which attains the altitude of 1000 feet; 6, Bombay itself, now on the Northward united to Trombay and Salsette, as these are united to each other by bridges and embankments, and to the Southward to 7, Old Woman's Island, and 8 Colabah; 9, Elephanta; 10 Butcher's; and 11, Gibbet island; 12, Caranjah; and 13, Henry; and 14, Kenery; with little rocks and islets of lesser note and name.

3.—Bombay, including the large and little Colabahs, is the only island of the group I have been able to examine with tolerable care, and it is the only one I have attempted to describe somewhat minutely, though not so much so as it ought to have been. I have traversed most of the other islands, some of them repeatedly: they seem all characterised by the same geological features, and I have introduced into the description of Bombay notices of their rocks, and of those on a part of the adjoining mainland, in so far as I have had the means of examining them.

4.—The principal rocks throughout this group of islands, are volcanic, but there are probably a greater variety of trap rocks to be found on the island of Bombay itself than on any similar area any where: the traps are interstratified by Neptunian rocks, chiefly of fresh water origin, and covered over with marine alluvium of three or four different ages and formations.

5.—The islands are separated by narrow creeks from each other (one of the most beautiful of which is that which forms Bombay Harbour,) often contracting to a few scores of yards in width, dry at half tide,

and widening and deepening as they approach the sea. The Tanna and Panwell rivers discharge vast torrents into these, deepenning and scouring them during the rainy season. Throughout the fair seasons, scarcely any water reaches them from the interior, and, unless where a strong tidal current prevails, most of them are in process of silting up. The back water occasioned by the railway embankment; and Mahim causeway, will, in all likelihood, speedily unite the islands of Bombay and Salsette into one. There are extensive spaces round the greater part of the margins of all these islands below high-water mark, and which are flooded during spring tides in all of them save Bombay, where the water has been shut out by embankment, and there are spaces still more extensive from three to twelve feet above the level of the sea, which must at no distant date have been submerged. The islands for the most part rise into round, or nearly flat-topped hills, varying from 100 to 300 feet in height—in one instance attaining the elevation of 1000—generally presenting a steep, sometimes a mural precipice on one side, with fine belts of cocoanut trees around the shore, affording an infinite diversity of woodland, mountain, lake, and river scenery every where; the creeks, assuming the aspect of lakes, rivers, or bays, according as they are viewed. The Bombay islands are, I should think, scarcely surpassed in picturesqueness and beauty any where in the world.

6.—The Island of Bombay, viewing it without relation to the two Colabahs, with which it is artificially connected, is in the form of an irregular oval, throwing out a long projection from one extremity, forming Malabar Hill and Point. The two islands of Large and Little Colabah, (Old Woman's island) now united to each other, and to Bombay itself, stretch out nearly parallel to Malabar hill, but extend much more to seaward, the two promontories terminating at Malabar point on the north west, and at the light house on the south including Back Bay between them. From the Light-house to Sion, on the Eastern, or Harbour side, the distance is about fifteen miles, and about twelve from Malabar Point to Mahim, on the Western side of the Island, which is about five miles across from Mazagon to Mahaluximee, where it is widest. It contains in all an area of about twenty-one square miles, on which there is a population of close on half a million.

BASALT FROM MALABAR POINT TO MAHALUXIMEE, AND SO BY BANDORA TO BASSEIN.

7.—*From Malabar Point* to Mahaluximee* is a fine bold ridge of black basalt nearly three miles in length, and about half a mile across, called Malabar hill maintaining for some distance an elevation of close on 200 feet above the sea. The ridge terminates in a precipice,† near the extremity of which stands one of the residences of the Governor, and it continues precipitous for a couple of miles on the Eastern, or Back Bay side: just under the highest part of the ridge the rock is tumbled about in huge masses, great irregular pillars partly buttressing the cliff, partly lying in gigantic ruins at its base. Along the Back Bay shore a considerable bed of stratified rock makes its appearance;—on the seaward side the hill slopes down somewhat gradually—from opposite the Back Bay beach and Love-Grove there are two independent ridges, near the Parsee "Towers of Silence" of unequal elevation, the lower being that by the north western shore. They are divided from each other by a deep dell of some half mile in length, and 3 or 400 feet across.

8.—The Malabar hill ridge is partly broken across near Tankerville, by the deep hollow through which the public road passes, but there seems no change in the character of the Rock on to Mahaluximee, where the basalt becomes tabular and looks from a distance like stratified rock, it here sinks under the level of the sea, and seems intersected for a few yards by a mass of strata set nearly on edge, stretching into the Bay opposite the residence of Sir Jamsetjee Jeejeebhoy. From this for about half a mile the rock is concealed by the velard—by the silt of the flats on the one side, and the gravel of the sea on the other, but appears to be the same as before. It re-appears in the beautiful little eminences of Ram Hill, Love-Grove, and the adjoining high grounds, and is once more partially interrupted by stratified rock, abounding in organic remains at the sluices, and again reappears just beyond, forming the wooded ridge of Worlee Hill. At Worlee village it disappears under the sand and alluvium, but there is no evidence of its being interrupted—it rises suddenly across the creek at the Portuguese promontory of Senora de

* See Section I., at the end.

† Mr. Clarke estimates (Geol. Trans. Jan. 1847) the thickness of the stratum of basalt above the trap at about 70 feet; so far as Malabar and Tardeo Hills are concerned it seems without the mark—it is nearly correct at the Love Grove section, to which he more particularly refers

Monte of Bandora, and continues as a great sea wall all along shore, for ten or fifteen miles at least.

9.—At the old castle on the south eastern extremity of the little island of Versova, it is columnar. Again on the west side of the island, facing Salsette, it is highly porphyritic, the felspar crystals embedded being nearly half an inch each way—they are of a dirty yellow colour,—the rock itself is brownish black. Just round the promontory, to seaward, a fine picturesque group of columns rises from high-water mark. They are of a pinkish brown with a tint of red, as if moss-grown, or weather-worn; they ring like metal when struck. When broken, it appears that this is the natural colour of the rock, which, though heavy and hard, is open and porous,—a hand specimen much more resembling sand-stone than trap. Further north it turns black again, and narrows to a pretty uniform well formed dyke, from fifty to a hundred feet across, rising here and there into picturesque little hills or islands, and appearing everywhere for ages to have walled off the sea from a low and easily abraded coast. At Bassein it runs into somewhat bolder cliffs, and presents several beautiful groups of columns, black and compact, like the rock at Malabar Hill: beyond this, I have not had the means of examining it. The basalt barrier seems broken through only by the creek opening into Bombay Harbour. Stretching southward and eastward from Malabar Point it re-appears at Alibaugh on the Coast, sixteen miles to the southward, and seems for a long distance to protect the shore. I have traced it for 70 miles from Bassein to Alibaugh: beyond this, again, my knowledge is at fault.

10.—From the basalt ridge just described, eastward, for the space of two miles, the island is almost perfectly flat, rising at the highest some eight or ten feet above the level of the sea: much of it would be submerged at high tides were the sea not artificially shut out.

TRAP, MOSTLY GREENSTONE, FROM THE PRONGS, THROUGH COLABA, THE FORT, MAZAGON &c., ON TO SION.

11.—A mass of trap, mostly green-stone, extends from the Light-house, at the extreme south-eastern end of Colaba, on all the way to Sion, on the eastern side of the island, facing the Harbour: instead of forming one continuous ridge, like the basalt from Malabar Point to

Mahaluxmee, it often sinks down to the level of the sea, where it is covered over with alluvium, and is only traceable in wells, quarries, and other excavations : it sometimes rises into knolls, sometimes into beautifully picturesque little hills, of above 100 feet in elevation. It varies as much in quality as in aspect, presenting us occasionally with a nearly black amygdaloidal green-stone,—next Parell, to the south of this, fine, soft, pale-blue, earthy trap—with every variety of tuffa, amygdaloid, and compact green-stone, that can be imagined.

12.—DETAILS.—The highest part of Colaba is that on which the light-house is built—it is about 55 feet above the mean level of the tide. From this the surface descends on both sides to the sea, sloping gradually to the N.E., in a line with the axis of the island. The trap here, as everywhere along our shores, is covered, at from six to ten feet above high-water mark, with sea gravel, loose or cemented. For upwards of a mile to the south-east, east, and westward, filling up a large space on the harbour side, and the bulk of the area of Back Bay, the trap is covered by the tide. The line of junction betwixt the basalt of Malabar Hill, and the greenstone of Back Bay, is lost under water: it is probable, from the aspect of the cliff, and the depth of water near its base, that a mass of softish stratified rock, through which the principal channel has been grooved, interposes itself betwixt them all the way along. Opposite the Marine lines there is a large mass of well formed columns of basalt, which just show themselves above low water—apparently beneath the fresh water strata at the base of Malabar hill,—becoming tuffaceous near the line of junction as if erupted from beneath, after the deposit of the alluvium now above them.

13.—About a mile and a half from the lighthouse towards the Fort, near the site of the Cabool Church, a mass of stratified rock makes its appearance on the harbour side of the island, showing itself along the sea shore near the Pilot's pier, and being pierced by the well near the Church : it does not quite cross the island, the green-stone re-appearing on the Back Bay side. Towards the Jamsetjee Break-water and Cotton-screws the rock becomes amygdaloidal, and presents us with a considerable variety of minerals. At the velard it seems much disturbed, the stratified and trappean rocks being mixed up together ;

but as it has not here been quarried to any considerable extent, and is much worn by the sea, no very distinct conception of its structure can be formed.

14.—For a large expanse southward and westward of the Fort the lower rock is covered over by a recent marine deposit: so far as can be discovered from the numerous excavations that have been made in digging wells, foundations of houses &c., the whole is a mass of trap up to the verge of the native town. During the month of May 1851, I examined the bottom of the wet ditch from end to end, and found no trace of anything but green-stone. This is visible all along the sea shore from the Apollo Pier to Nowrojee Hill—a mass of it rises to the surface at Bombay Green, and again near Fort George. A little beyond this, it has been quarried to a large extent, the quarry now forming a tank. The rock here, as also in the wells near the Church Gate, and so probably over this division of the island altogether, is dark coloured, hard, brittle, and splintery, difficult to work, and not well adapted for building purposes. About a mile beyond the Fort Gate, the trap rises abruptly into a picturesque eminence of some 150 feet in elevation, called Nowrojee Hill. The Harbour face of this has long been used as a quarry, and presents a perpendicular scarp of massy trap rising in blocks of great regularity in point of form, and of any size that may be desired: a bed of stratified rock, nearly horizontal, and about a foot thick, afterwards to be described, traverses the face of the precipice—a lower bed makes its appearance by the sea shore. For a quarter of a mile or more by the line of the railway, and on to the wood-yards, the surface descends to within a little of the sea level, and then rises abruptly into the bold eminence called Mazagon Hill, attaining an altitude of about 180 feet: this, so far as it appears, consists wholly of greenstone. A little to the northward of this, the surface for three miles or so becomes nearly flat, and at the Powder Works consists of a mass of trap tuffa, of a pale greenish tint, curiously intermixed with veins of calcareous spar running through it in all directions. The tuffa extends into the interior of the island, assuming a vast diversity of forms, until cut across by the stratified rock in the flats, which is succeeded, as already stated, by the basaltic ridge along the sea shore on the west.

15.—At Chinchpoogly the greenstone once more rises into a fine bold ridge, which attains the altitude of 150 feet at Parell Flagstaff, and continues unbroken for the space of two miles. Betwixt this and the sea on the Harbour side, the ground undulates in three successive ridges, nearly parallel to each other, one overhanging the shore, and one betwixt this and that just described, the two last being broken and irregular. Though the uniformity of the external aspect of these might lead to the supposition that the structure of the rocks was the same throughout, this is far from being the case. The bolder and more elevated portions of all the ridges consist of fine-grained compact greenstone, with very few minerals imbedded. In the portion of the hill south of the flagstaff, where the road crosses from Sewree to Parell, a curious mass of tuffa intrudes itself; externally, it is so blackened with the weather as not to strike the eye as in any way differing materially from the rocks around—when fresh broken, it is for the most part almost white. It will be found more minutely described under trap tuffa. Each of the ridges rests on a series of strata full of organic remains, and which, with the tuffas, occupy a very extensive space betwixt the beds of trap. The Fort of Sewree is built upon a mass of black rock, which might at first be readily mistaken for basalt—it is, in fact, a Lydian stone, a black jasper or chert, the result, most probably, of the action of the volcanic rocks around on a stratified clay bed: the strata are still traceable in the midst of the fusion to which they have been subjected. A series of flats, from which the sea is excluded artificially, and on which salt is extensively made, here prevail, and the surface of the island seldom at this place rises more than a few feet above high-water mark, and generally bears obvious traces of submergence. A beautiful group of little hills make their appearance opposite the old artillery grounds, Matoonga, and so continue to Sion, at the extreme end of the island. The southernmost of these consists of the jaspideous rock, or chert, of which Sewree Fort is composed,—the rest in general of various descriptions of trap tuffa, with occasional exhibitions of greenstone.

THE CENTRE OF THE ISLAND.

16.—Betwixt the two sets of ri[illegible] just described—the [illegible] ridge from Malabar Point to [illegible]n, and the [illegible]

tuffaceous series of eminences from the Lighthouse to Sion Fort,—the island is almost perfectly flat, about a fourth of it being in reality under the level of the sea, the waters of which are excluded by embankments, walls, and sluices. This space is covered over with various sorts of alluvium, afterwards to be described, mostly of marine, and much of it of very recent, origin. Though recent railway operations, with the excavations for the supply of water during the dry season, have helped to enable me to trace formations here completely concealed by the superficial beds, a very imperfect idea is all that can be afforded of the character or position of the rocks constituting the lower parts of the island, though there is much reason to believe them mostly soft argillaceous stratified beds, such as prevail at Love-Grove sluices, and near Sewree.

17.—It is quite clear that at a comparatively recent date, probably within the human period, Western India has suffered from a succession of upheavals and depressions, and that just before the latest of these, instead of a single island, Bombay consisted of a group of at least seven islands. Still more recently than this, and quite within the reach of tradition, if not of history, Colaba formed two islands, and Bombay itself either three or four, these being united at low water, the sea at spring tides effectually dividing them from each other. Mahim is mentioned in an old MS. as forming a distinct island, and it is mentioned as still so continuing when Dr. Freyer visited Bombay in 1680. "In the middle of the Island," says he, "between Parell and Maÿem [Mahim,] Seeam [Sion,] and Bombaim, is an hollow wherein is received a branch [of the sea] running out at three several places, which drowns 40,000 acres of good land; athwart which from Parell to Maÿem are the ruins of a stone causeway, made by Pennances."* The three places where the sea found admission are clearly at the Worlee and the Sion sluices, and the openings at the Mahaluximee and Love-Grove velard, which would at once constitute Mahim town and woods, Worlee Hill, and Love-Grove, into three separate islands,—their insular condition continuing till the construction of the walls now uniting them excluding the sea.

18.—The neighbourhood of the Mazagon Gaol is termed *Omarkadee*, *kadee* being the word always applied to salt water creeks dry at ebb tides: the neighbourhood of the temple of Mombadaví is called Pae Dhonee, or

* New account of Persia and the East Indies, betwixt 1680 and 1688. By Dr. Freyer, F. R. S. 1 vol. fol. London: 1697.

the place of the feet-washing, and traditions still exist to the effect that the sea flowed from the west up to the former of these, until excluded by the embankment from Mahaluximee to Love Grove, constructed above a century ago. Pae Dhonee was a ferry, where persons arriving from Salsette used to wash their feet in a salt creek in approaching Bombay; Mahaluximee was formerly only accessible from Bombay by boats.* It is singular that we should have no more direct information than this to go upon as to the physical condition of Bombay when surrendered by the Portuguese to the English little more than two centuries ago; but it is clear, from what we know, that at this period Colaba formed two islands, the lesser of these being known as Old Woman's Island, described by Dr. Freyer as "a dry sandy spot, of no further value to the Comp any than as affording grass to their antelopes and other beasts of pleasure." The space now occupied by the Fort, and a part of the Native Town up to Pae Dhonee, formed a second, and it is probable, from the aspect of the shore, that this was united to Malabar Hill by the sandy ridge betwixt Girgaum road and the sea,—a very slight diminution of the existing altitude would have allowed the sea to sweep clean through from Mahim to Back Bay. Though the sea must at no distant period have swept across from Love-Grove to the Harbour just to the south of Chinchpoogly Hill, it is not quite apparent that it did so within the time specified—at present the Parell road is considerably under high-water mark. From this on to Sion, the land must have been continuous back to the period when the existing levels were established. The last upheaval seems to have elevated the island from eight to ten feet, and a depression to this extent would have greatly multiplied the number of islands constituting the group; the sandy flats, subsequently only covered over at high-water, being then for the most part in a state of continual submergence. The scenery must then have been still more picturesque than at present, when yet more beautiful by Nature, and undeformed by the outrages on Architecture prevailing amongst us.

19.—If the reader has carefully consulted the map and sections while perusing the text, he may probably consider the general topographical account of the island just given sufficient: it includes in it some of the information about to be furnished in detail, and therefore

* Abridged from a very able paper by Mr. Murphy on the Aborigines of Bombay, in the 1st vol. of the Trans. of the Bombay Geographical Society.

involves me in some repetition: the apparent clumsiness arising from this will probably be more easily excused than the obscurity which might have followed the want of it. In the following detailed description, I shall take the surface formations first, and so proceed downwards.

DETAILED DESCRIPTION.—LAGOON FORMATION.

20.—ALLUVIUM.—1. Lagoon Formation; 2. Littoral Concrete, or raised Sea Beaches; 3. Blue Clay, or submerged and reclaimed silt; 4. Lower Alluvium, or Old Marine Clay; 5. Red Earth.

21.—The uppermost and most recent is that to be met with all over the Flats in the centre, and salt pans on the Eastern side, of the island, denoted by the bright blue on the map. It is of somewhat uncertain depth—it is nothing more than the sea sludge comminuted trap, deposited before the waters of the ocean were shut out artificially from the region where it prevails, and so back to the period when the island began to emerge from its previous depression to its present level. We have thus two blue clay formations, running both in point of time and composition into each other, and betwixt which, unless where beds of different character intervene, no distinct line of demarcation can be drawn. The very appropriate name of Lagoon Formation was conferred on the uppermost of these by the late distinguished and lamented Captain Newbold. Our Flats still occasionaly appear as a lagoon, when the sluices are left open at spring tides, and on these occasions of course a slight addition, identical with the deposit, is made. The lagoon formation, though in certain circumstances gliding insensibly into the old blue clay of a former age, is in general, chronologically speaking, separated from it by a very distinct and well-defined variety of rock, on which I have conferred the name of littoral concrete. Before things can be made intelligible, I must be permitted a few preliminary remarks in reference to the two formations just referred to.

EVIDENCES OF AN UPHEAVAL AND DEPRESSION ALL ALONG THE SHORES OF INDIA,—PROBABLY OF THE WORLD.

22.—The alluvium around Bombay commonly prevails in some such state as the following:

1st.—Ten Feet above the Sea.—1. Sea Shells, and sea-gravel and sand, loose, or cemented into a variety of open shell limestone, three to ten feet thick, called Littoral Concrete.*

2nd.—Blue Clay, full of Mangrove roots—sometimes but slightly, sometimes entirely, decayed—always in the position in which they grew, and perfectly undisturbed.

3rd.—Rock. Or sometimes the following:—

1.—Littoral Concrete.

2.—Rock.

Or,

1, Blue Clay, with mangrove roots, as before.—2, Yellowish brown clay, with concrete in the ordinary forms. I have not met in with all these at one place complete, but have no doubt that they are to be found in abundance.

23.—From this arrangement the following inferences are deducible:—1. At the time the Mangroves grew, the blue clay must have existed at about half tide mark, the mangrove being a salt water littoral plant only found some way within tide mark.—2. Before the large masses of shells and gravel could have been brought into existence, the mangrove-bearing beds must have sunk so as to suffer the sea to wash over them, and the shell deposits to accumulate, and the downward movement must have extended sufficiently far to permit the uppermost portion of these to be occasionally at least under high water: it is regularly stratified, and contains the heaviest and largest-sized shells now found on our shores disseminated equally throughout; has not the slightest appearance of sand-drift, and could in no other way, save that explained, have come into existence.—3. It could only have reached its present position by a subsequent upheaval, which brought matters into pretty nearly their present position.†

* Near the fishing village of Sewree, on the Parell side close by the shore, a bed of brown earth about fifty yards in length, uncertain in extent, reposes on the littoral concrete, and a second bed of similar depth, formerly cultivated as garden ground, and irrigated by finely built conduits, appears. In the mass itself I have not been able to discover any remains strictly belonging to it. On being dug through, the concrete is always found below—it is probably an upper bed of sea silt changed by cultivation. I have been unable to determine its character, and as it is *possible* it may have been brought there artificially, I have not noticed it in the text.

† This will be found pretty fully adverted to in the Annual Report of the Society, read May 1850. I subsequently prepared a paper on the subject, which was published in the Edinburgh Philosophical Journal (Jameson's,) and in the Transactions of the Bengal Asiatic Society; and, a considerable additional supply of facts having reached me, prepared another for the British Association. It was read at Ipswich in Jan. 1851, and will I presume appear in their Transactions. Parallels to these phenomena will be found in the upheavals and depressions which have actually occurred at Chittagong, and along the Arracan Coast, within less than a century of the present time.

24.—That these things have been brought about by movements of the land, not by advances and recessions of the sea, is obvious from the diversity of levels at which the various beds are found, and the obliquity, and frequent incurvation and dislocation, of the strata, this last being peculiarly manifest opposite the village of Sewree, where they dip towards the east, in a direction the opposite of that of the fresh water beds contained in the trap, which come afterwards to be described. Near Sion the soil of the rice fields obviously composed of the blue clay altered by cultivation, is considerably higher than some of the older alluvia along the line of the Mahim road beyond Byculla, over which no recent marine deposits can be traced, though in reality they are at present several feet below spring tides. The depressing process would seem here to be still in progress—we have no reason to suppose this to have been subject to tidal inundation 170 years ago, when Dr. Freyer wrote, though he distinctly describes the isolation of Love Grove and Mahim.

LITTORAL CONCRETE, OR SHELL GRAVEL DEPOSIT.

25.—*Its Character.*—As we have no river or recent fresh-water deposits, the upper marine beds constitute the newest of our formations, seeming to belong to the post-pliocene, or recent deposits, the materials of which they consist being identical with those now on the sea shore. The mass varies from ten or twelve feet to a few inches in thickness: it is in general laid down in regular beds, for the most part petty nearly horizontal, and having no appearance whatever of drift. The material is sometimes perfectly loose, and without any mineralization whatever: most frequently it is united by a calcareous cement into a tolerably firm shelly rock. The larger shells are often filled full of spar, and on many occasions the external coating is all that remains of them, the walls of the shell itself being transformed into crystalline limestone. In this form it constitutes a valuable building stone.* It is a curious fact, that it often appears in these two opposite conditions in places closely contiguous to each other. On the western half of the Esplanade, from near the Church Gate road to the Native Town, it is in the condition of rock. Near the Native Town more especially it is highly

*See note B. at the end for the mode of working littoral concrete for the purpose of architecture.

crystalline, the material excavated from the Dhobee Tank in April and May 1851 being to the depth of twenty feet continuously* crystallised throughout. To the eastward again of the Wellesley Monument, and all along from the Cooperage to Malabar Hill, within from 100 to 200 yards of the shore, the material is perfectly loose from the surface down: it abounds in fresh water, and notwithstanding the porousness of the soil, is favourable for the purposes of cultivation.

26.—In excavating two large wells near the Wellesley Monument, the shell gravel was found to extend down eighteen feet, to the trap; the lower beds being of sand were being dug through, when the water flowed so freely at the dryest part of the season that it materially interrupted the work. Here large masses of coral were found, such as is now growing in Back Bay: it occupied the position in which it grew, and had neither suffered from decomposition, mineralization, or abrasion. This variety of coral never appears on our shores as a rock, for having attained the thickness of six or eight inches, and an area of a square foot or two at the outside, the zoophyte seems to die, and the stony covering to become detached. On this the coral almost immediately becomes abraded and worn, and is found in rolled masses on the beach. The inference from the condition of the coral found under the shell gravel on the Esplanade, is, that it was suddenly submerged, and at once buried so deep in sand and gravel that it was beyond the reach of further injury: how the water which pervades the whole shelly and arenaceous beds in Bombay should within such narrow limits be possessed of such different properties—crystallising the shells at one place, and filling up their cavities into a solid crystalline mass, and leaving the whole gravelly mass unaffected in others close by,—is not easily explained.

27.—Where the shells are generally cemented and mixed with argillaceous matter, as for example where the railway cuts through the road opposite Mahim Wood, and again near Sewree Fort, the formation becomes exceedingly hard and compact, with an earthy in place of a crystalline appearance.

28.—*Where found.*—The formation, the peculiarities of which have thus minutely been described, first makes its appearance on the sea shore south of the Lighthouse, and forms the graveyard at the root of

* See Reports of the Society for April, p. xlv.

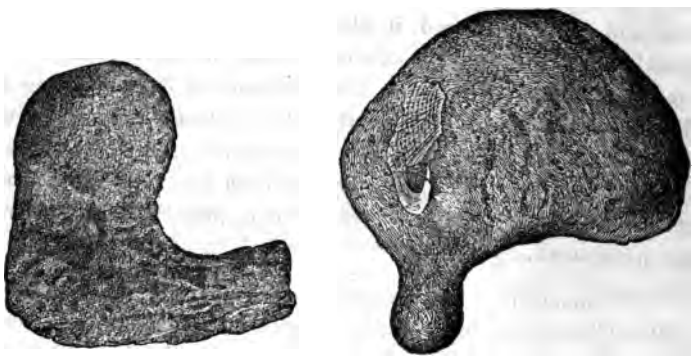
the Prongs. On the Harbour side of the island it reaches along the shore as far as the Pilots' Pier, constituting a considerable portion of the Observatory compound up to the l evel of about ten feet above the sea. It forms the grounds of the Lunatic Asylum, and the drill-ground betwixt the Catholic Chapel and Cabool Church, and so extends wherever the level of the ground does not exceed twelve feet, to the end of Colaba, near Bombay. A large portion of the lower part of the Fort is built on it: it forms the whole of the Esplanade, extending from the Apollo Pier to Malabar Hill, and so under the lower portions of the Native Town. It appears a hard compact rock a little to the eastward of the Gowalla Tank: near the Garden House of Juggonath Sunkersett it exists as loose shell gravel: a little beyond this it vanishes. Around the base of the hills near Mahaluximee, and close up to the end of the Love Grove velard, it narrows out into a thin border of gravel, and so continues by the shores of Love Grove and Worlee Hill. The whole of the level Cocoanut grounds which constitute Mahim Wood are formed of it, and it forms the little neck on which the fishing village stands connecting the castle rock of Sewree with the hill. It is found all along the low shores of Salsette, Versova, and the islands to the north, and the whole of the low grounds by the shore to the southward. A large isolated mass of it presents itself on the line of the railway, most opportunely for the ballasting of the work, near the haystacks, half way betwixt Byculla and the road to Parell. The material here is loose and incoherent, and it abounds with the fragments of kunkur from the blue clay and the calcareous tubes from the mangrove roots about to be described. From this circumstance it seems likely to be still more recent in its formation than the substances referred to, which do not appear to have come into existence till after the emergence of the blue clay with the concrete over it from the sea. This mass of gravel, which is altogether embedded, is at present below the level of high-water mark.

BLUE CLAY, WITH KUNKUR, AND MANGROVE ROOTS.

29.—*Character.*—Immediately beneath the formation just described, unless where this rests directly on the rock, is a bed of bright blue clay, highly calcareous and charged with salt, nearly identical in appearance with the sludge in our estuaries and along the shore. It varies from a few inches to several feet in thickness: its upper margin is at present

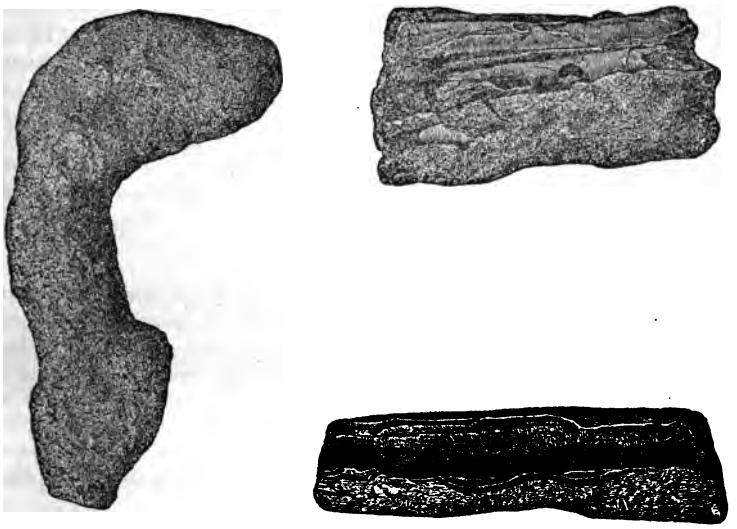
about afoot or so below high-water mark. It generally abounds with the roots of the mangrove, obviously still remaining in the position where they grew—the fragments of the stem stand some inches above the clay. I have never been able to find any remains of them in the concrete above. The hue and substance of the wood is in some cases but little changed—the fibres are still tough, their colour red, and somewhat more dark than that of mahogany. For the most part, however, the roots are cemented into a black, softish, peaty matter, which crumbles in the hand : it cracks in drying, and when dry is brittle and lustrous, like coal. It burns without either flame or smoke : long exposed in the damp, it first becomes coated with a thin film of sulphur, its cracks being occasionally filled with pyriteous matter. Occasionally it becomes covered over with beautiful greenish white speculæ of sulphate of iron. This salt is so abundant in the lignite beds near Quilon as to be collected and made use of for the purposes of the dyer. The clay is full of nodular masses of greyish coloured limestone, from the size of a pellet of small shot to that of the hand,—a variety of the substance called kunkur, which prevails all over India, and furnishes the bulk of the mortar used in building.* The kunkur of the blue clay formation is remarkable for the extraordinary resemblance its nodules bear in point of form to common chalk flints ; a resemblance so striking that but for a slight difference in point of tint, the most practised eye could not discriminate betwixt them.

30.—The Mangrove roots are full of perforations, obviously made by some marine worm : they vary from the thickness of a goose-quill to that of the thumb.



Various forms of nodules of Kunkur from the blue clay beds :—resemble chalk flints in form, and form excellent water-cement.

* For a description of Kunkur, see Note C. at the end.



Various forms of nodules of Kunkur from the blue clay beds:—resemble chalk flints in form, and form excellent water-cement.

Form of shell most frequently found in littoral concrete—transformed into calcareous spar—nothing of the original but the epidermis remaining. At Madras they are, under similar circums tances, converted into selenite.

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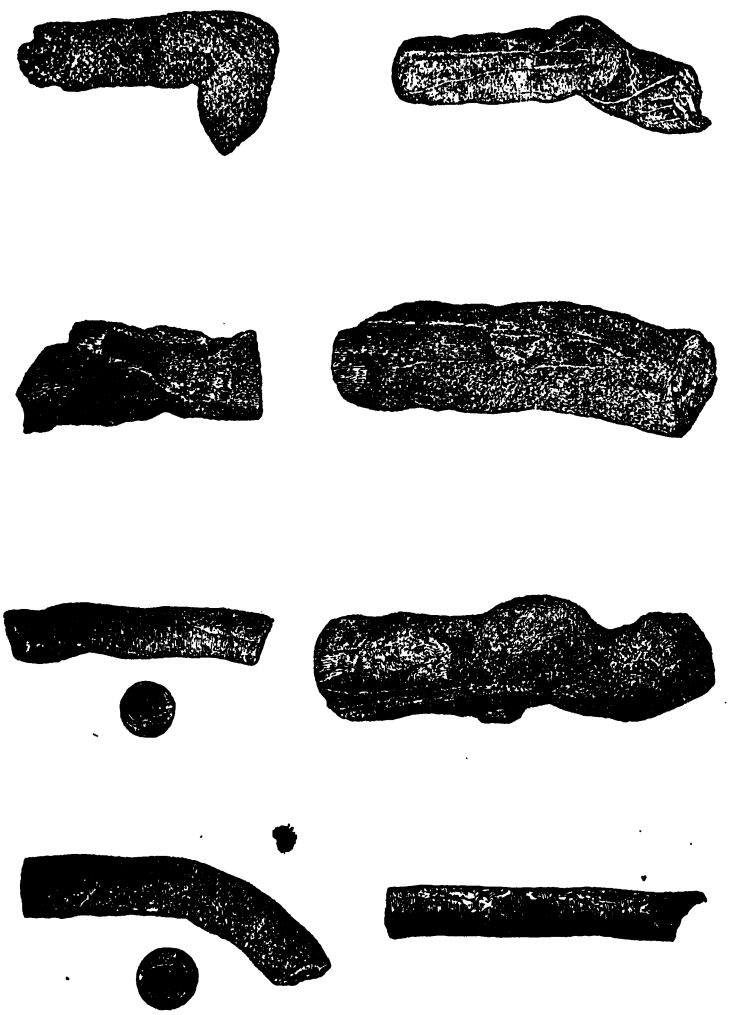


Various forms of calcareous tubes—some hollow, some filled up with common kunkur found in the perforations of decayed mangrove roots, in the marine blue clay formation.

These borings often extend for several feet in a line continuously :—they are invariably coated with a lining of pinkish white carbonate of lime, varying from a few lines to $\frac{1}{16}$ of an inch in thickness. Its tint and texture is not unlike that of some varieties of satin spar ; it is crystalline throughout, but has evidently been deposited in successive layers, of which fifteen or twenty may occasionally be counted. It seems probable that the outermost of these coatings may have been deposited by the worm which bored the hole—similar borings, but of very much smaller dimensions, are still found in the decayed specimens of the root of the mangrove growing on our shores, the calcareous coating being in this case however as thin as paper, and equally polished on both sides ; and that this was thickened afterwards by deposits of pure carbonate of line from the rain water of the monsoon,* this at times going on till two-thirds of the boring are filled up by the spar. The walls of these tubes are always thickest on the lower side, especially when the deposit has been considerable, and they are generally uneven inside : outside they are smooth and polished, conforming entirely with the shape of the boring which forms the mould. When found in *situ*, these tubes are generally filled with portions of the blue clay from the surrounding beds. This in many cases is hardened into kunkur of the form of the interior of the tube, of the texture and substance of the nodules around : in many cases, the fine sparry coating has been partially or wholly eaten away or redissolved by the water, so that nothing but the kunkur core remains. The perforations and fangs of the roots have frequently been filled up from the outset with clay, which has become kunkurized, so to speak, furnishing a cast. It is very seldom that they have any internal organic structure, though I have met with a few cases of the opposite, so that they are merely casts and organic in external aspect, and partake in no way beyond this in the character of petrefactions. The best open section of the relation betwixt the concrete and blue clay is that on Sewree beach, where all the characteristics of both formations are fully manifested, and it will be seen from the litographs that the appearance presented by it is not unlike that of the dirt bed of Portland.

31.—The blue clay with the mangrove roots, and all the other characteristics already referred to, is found in all the wells I have met in

* This explanation is suggested by Dr. Carter, to whom I have submitted specimens of all the varieties of encrusted borings—it seems to meet the circumstances of the case.

with in Mahim Wood, and in most of those under the western portion of the Esplanade, the same as at Sewree; as also along the line of the Grant Road, and so to Juggonath Sunkersett's house: it crops out under the sands betwixt the rocks in the upper part of Back Bay and the Sanitarium: it is found forming the rice fields betwixt Matoonga graveyard and Sion, transformed into the ordinary brown earth of our higher grounds, and recognisable chiefly from the tubes which indicate the former existence of mangrove roots.

32.—Whenever the excavations in the places enumerated are first made, a very powerful effusion of sulphuretted hydrogen gas is emitted,—so much so at times, as to taste the water and taint the air around. I have met with no good section near Sion, or in the higher portion of the Flats betwixt the Club and Love Grove, but the kunkur and the tubes abound on the surface in both of these localities: I have no doubt the arrangements are the same. When tolerably free of salt, the blue clay, as in the case of that under the esplanade, answers for pottery purposes, but it shrinks greatly, and is apt to warp in drying —it burns into a dirty yellowish red. When much contaminated with salt, as is the case of that in the flats, it is most difficult to sweeten it: I have washed specimens of it in a tub for the whole course of a monsoon, and to the last found the water with which it was washed slightly salt to the taste. When thrown or moulded in this state it promises admirably, and turns when green like fine horn—the moment it is further dried it crumbles to pieces.

33.—Along the line of the railway, betwixt Mahim Road and Sion, the concrete is awanting—the blue clay extends from the surface down to the rock. The Lagoon formation, or newer clay, covers the fractured portion of the mangroves, here penetrating to the depth of from one to two feet, the railway cuttings furnishing excellent exhibitions of both. Here selenite is found in abundance, filling up in plates the cracks of the clay. The plates are generally oval, thinning out at the edges all round—sometimes they are lenticular: they vary in size from an inch to four inches in their larger, and about half as much in their smaller, diameter, and from one-sixteenth to half an inch thick. Externally they are rough and earthy, of a greenish or yellowish brown tint: when held up betwixt the eye and the light, a beautiful feather-like object makes its ap-

pearance along the axis of crystallization—it can be rendered beautifully distinct by grinding the specimens on their thinnest side, then polishing them. The selenite plates are always found on edge, and they split with much ease, with a perfectly smooth and brilliant surface and even texture, in the direction of their larger axis, and at right angles to their plane: this, so far as I have observed, holds uniformly, and forms a striking contrast to the more extensive deposits of the same mineral in the deserts of Egypt and of Scinde, where in the great majority of cases the plates do not break across, but split in the plane of the plate, or parallel to the plane of the walls of the vein. I have not met in with any fibrous or compact specimens of the mineral of Bombay; they are plentiful in Scinde and Egypt. The formation of the selenite, like that of the kunkur, is now in progress, and is very easily explained. The sulphates of soda and magnesia of the sea salt decompose the carbonate of lime, and afford carbonate of soda and magnesia, which at Bombay is washed away by the rains, and sulphate of lime or selenite remains.*

34.—In cutting the Town Drain, vast masses of oyster shells were excavated from the blue clay about five feet under the surface, to the southward of the Grant Road, and nearly opposite the Grant Medical College; and again in the railway cuttings opposite Parell, and near the village of Matoonga: they seem identical with those now abounding on our shores. They are of very large dimensions, and a single mass of them adhering firmly together was sometimes detached nearly half a ton in weight. The surface of the ground here is set down by Mr. Conybeare as about two feet under high water spring tides—so that the surface of this portion of the Island must a century since have been liable to occasional submergence.

35.—Lower Alluvium—Yellow Earth.—The cuttings through the Flats along the line of the railway afford an excellent exhibition of a third alluvial formation obviously of much older date than the blue clay: it is of a chesnut brown, or yellowish brown colour, the tint becoming lighter as we recede from the surface. It is less liable to crack during the hot weather than the blue clay, especially where regularly cultivated: in moist, or seldom tilled spots, such as those around the Byculla Schools, it cracks and splits in all directions, the fissures often

* See Note D., at the end.

extending several feet into the ground,—the earth where freshly excavated presenting in many cases a glossy striated appearance in the walls of the fissures. I have never met in these beds with any fragments of wood or other vegetable matter, truly belonging to them, and they are nearly devoid of all organic remains. I felt at a loss whether to assume it to be of marine or lacustine origin, when the excavation of a large tank near the Railway, betwixt the Bishop's house and the Byculla Schools, solved the difficulty. The surface here, as estimated by the line of the railway, is twenty feet above the level of the sea—at least eight feet higher than the most elevated of the newer marine formation. Six feet under this the yellow earth was found to abound with nodules of kunkur, of a hard arenaceous semi-crystalline texture: a piece of the shell of the thin paper or pearl oyster formed the nucleus of each nodule: the shells where not protected by an encrustation of kunkur, had all apparently been dissolved out. This solved the question: the lower alluvium had originally been a marine deposit,—blue clay, or silt most probably,—which on being elevated and long exposed to the air and rain, had had the marine remains, and probably the original flint-like nodules of kunkur, dissolved out of it. Common oyster and other shells were afterwards found in fragments, but not in such numbers as to enable the age of the formation to be determined. The kunkur with which the lower alluvium abounds, is of a somewhat paler tint than the soil itself: it is the same in point of external appearance as that generally prevalent in the interior, and bears no resemblance whatever to the smooth and fantastically shaped nodules found in the blue clay. It is rough and amorphous, often runs out into long branches like coral, and has always a fibre of grass, or some other vegetable, shell, or mineral substance, in the centre—the primiary nucleus, around which the lime had originally deposited itself. In the absence of woody matter the peculiar form of the kunkur and aspect of the soil itself makes this readily distinguishable from the formations just over it; though, if it was, as I have assumed, originally a marine formation, the cause of these differences is not easily explained. It is probable, at the same time, that the nodular kunkur found in the salt clay may by long exposure to the actionof fresh water have been redissolved, and the lime contained in it a second time thrown down in the form in which it is now found. The lower alluvium forms the soil of

nearly all the higher portions of the island, with the exception of those where the substance about to be described—the Red Earth—takes its place. Betwixt the railway and Byculla it is about twenty feet above the level of the sea: it is found to the depth of fifteen feet from the surface, and is nearly uniform in its appearance throughout. At Mr Dickenson's house again, as already stated, and so along the Mahim Road, and across towards Chinchpoogly, it is several feet under the level of the sea: yet no *recent* marine deposit is discernible over it, furnishing a presumption that a considerable amount of subsidence has occurred since the tide was excluded by the works betwixt Mahaluximee and Love Grove about a century ago, at which time it must, it would seem, have been higher than at present.

RED EARTH—DECOMPOSED TRAP.

36.—*Lall Muttee* of the Natives. I am not aware that the two preceding formations have any particular name or designation amongst the natives. That about to be described is called *Lall Muttee*, or red earth, in contradistinction apparently to the ordinary soil on the one hand, and the moorum on the other; the term moorum being indiscriminately applied to decomposing trap, soft sedimentary rock, or anything which is too hard for agricultural and too soft for building purposes. It seems unfortunate that a term of such vague significance and general application should not, when used by men of science, have the precise meaning to be in each particular case attached to it explained. The red earth, so far as I know,* is always found lying immediately over greenstone, or some similar variety of friable trap: I have never unless in Salsette—(post, p. 38)—met with tuffa, much less with sedimentary rocks under it. It is of a brightish or brownish red colour, nearly that of brick dust. About two-thirds of the whole consists of stony pieces, about the size and form of horse beans. These are for the most part glazed and shining externally—internally they are black and earthy, like softish trap. The matter in which they are imbedded when washed out and by itself forms a fine plastic red clay, which suits well for the purpose of the potter, being easily moulded or thrown,

* The reader must be cautioned as to the weight to be attached to my authority on this matter. Tied down by professional avocations to Bombay, my observation has been in a great measure limited to the Island, and though it is impossible wholely to avoid generalisation, it must be remarked that I have generalised on very limited data.

and standing a very high degree of heat without softening or warping: all our other clays fuze at a red heat, and are most intractable as material for pottery. It requires some forethought and preparation to procure it in sufficient quantity for the potter; and, wretched as is our other material, it seems never to have been thought of for pottery purposes, till a large bed of the finer portions washed free of stones was deposited by the Monsoon of 1851 close by our School of Industry brick-field, and its qualities thus became immediately known to us. On first being exposed to the air, or subjected to cultivation, it refuses to sustain vegetable life; no plant whatever will grow upon it, and it remains without vegetation during the wettest season when the rocks themselves are almost green. With moderate manuring its character in a few months' time becomes completely altered,—the stony pieces disappear from it, it changes its colour from red to brown, and becomes a fine uniform unctuous soil, remarkable for its fertility: the alteration may be effected in a few weeks' time during the rains, and then it becomes fertile in the extreme, each successive crop improving its qualities and texture. It is greatly sought after by gardeners for mixing up with the other more promising-looking, but in reality less productive, soils. In the red earth large concretionary masses, from the size of the fist to that of the head, or upwards, are frequently found, to all appearance aggregations of the earth itself. Externally they are glazed and of an even texture: internally they are compact, corroded, and vesicular,—so perfectly like the more ordinary varieties of laterite that it is difficult to distinguish the one from the other,—the only difference betwixt the two being, that the one is a shade more rusty in its tint than the other. These concretions are often seen to all appearance in the act of forming—they are much heavier and more compact than a similar volume of red earth, and yield with considerable difficulty to the hammer. Crystals of sileceous spar, and a curious variety of laminated quartz, are found embedded in the red earth: I have not met with any other trappean minerals it it, but then I have not happened to fall in with specimens of the earth near any of the rocks in which minerals abound.

37.—*Situation.*—The red earth is always found on the surface of trap, often in immediate contact with it, and enveloping it on all sides, though there generally is a mass of rusty-coloured, or yellowish

earthy matter, obviously the rock in a state of decomposition, between them. For five or six feet occasionally it is entirely free of rock, and is throughout of perfectly uniform hue and texture. In general, however, numberless masses of boulder trap, from a few inches to several feet in diameter, are found thickly imbedded in it: it fills up the intervals betwixt the masses of trap, to the depth of fifteen or twenty feet, and is occasionally found beneath them: I have never met with it lower down, and the lowest loose matter amongst our traps is soft yellow ochrey earth, obviously the result of decomposition, and which is found in all stages of decay. I have not met in with it, at the surface, in point of level anywhere so low down as our recent marine formations, so as to be able to observe the effect on it of having been submerged. The boundaries of the red earth are abrupt, and it seldom shades or merges into any other rock: the trap in contact with it seldom manifests signs of decay; the earth is never stratified, and exhibits no appearance of watery deposition: and amidst the difficulties of explaining its appearance, I have come to the conclusion that the probabilities on the whole are in favour of its being of trappean origin, or rather of its being trap in a state of decomposition, hard as it is to reconcile this assumption with many of the most notable circumstances attending it.

38.—Red Earth abounds at the southern extremity of Colaba, over the greenstone around the Observatory: it forms an integument over the basalt of Malabar Hill. It prevails in large masses along the ridge betwixt Chinchpoogly Hill and the sea, near the School of Industry. The railway passes through a deep cutting beyond Sion, just as it enters the island of Salsette. The rock here is a purplish tuffa, which will by and bye be described (see extract from Dr. Carter's paper, para. 42). The red earth is of a brownish tint, much less red than it generally is, more friable and fertile looking, and free of the small stony particles which characterise it. I have not met in with any ferruginous concretions in this variety of rock. The peculiarities under agricultural treatment are given from my own observation as a cultivator. The red earth presents us with a striking contrast in this matter with the regur or cotton soil, which is distinguished for its fertility from the outset, without requiring any aid whatever from manure for centuries of constant cultivation: the red earth is fertile only when fed with organic matter. If both be, as has very often been supposed,

the debris of the trap on which they rest, no two substances ever owned a common origin in all their characteristic features so perfectly dissimilar.

39.—ERRATIC MASSES. *Laterite.*—This closes the list of our true alluvia, and before proceeding to describe the older rocks, a short notice of the erratics, few in number as they are, may here be given. Though granites of all descriptions, five or six varieties of limestone, quartz, hornstone, &c. &c., are occasionally to be found on our shores, Laterite* is the only one deserving the name of erratic, the other rocks and specimens, with the exception of the hornstone, appearing all to arrive in the form of ship's ballast.

The nearest point at which this singular rock occurs in *situ* is thirty miles off: though great abundance of it in all its varieties is to be met with all around our shores, I have not fallen in with any specimens of it in the interior of the island. It is found on the little island of Kenery, separated by seven miles of deep channel from the mainland; along the shores of Versova and Salsette, and so on to Gogo, on the further side of the Gulf of Cambay, by which it is cut off from all the laterite formations —it is not found in Kattiawar—how much further north I know not, this being the limit of my experience. Great blocks of it are seen built into the fort and walls of Surat—brought I presume from the seashore to the northward along with the other building material, there being no stone of any sort in the neighbourhood. In absence of all idea of glacial action, the only explanation that can be given of the appearance in such abundance of a rock so heavy, so loose in its texture, so friable and apt to suffer from disintegration, at such distances from its proper habitat, is that at no great distance of time it prevailed over a larger area than that which it now occupies, and that the fragments now found are the scanty remains of the masses removed by denudation before the emergence from the sea of the lands over which they prevail. I admit that this seems a strained, and is a very ill-supported, hypothesis, yet I know not what other there is that will so well explain either appearance. The abundance in which the laterite is found prevents the idea of artificial transportation. I have *thought* I could sometimes detect it imbedded in the blue clay formation, but do not feel sufficient-

* See Note D. at the end of the paper.

ly assured to pronounce on the point. It is mentioned by Mr. Prinsep as amongst the materials brought up by the boring tools from the Delta of the Ganges in seeking for water at Calcutta,—and is probably the ferruginous clay found in the borings at Madras: in both these cases it might have been brought by streams from the mountains under the present state of the earth's surface.

40.—FRESH WATER BEDS ALTERNATING WITH TRAP.*—The outcrop of the fresh water beds is almost invariably under high-water mark both on the shores and in the interior of the island, and in the latter case it is covered over with a thick mass of alluvium, which, being mostly salt, has seldom been dug through in search of fresh water. There are no streams or river channels, and no cuts or excavations of any considerable magnitude across the strike of the rocks, and, with the uncertainty created by the sudden descents and upheavals, dislocations and disturbances, which occur in trap, it is not easy to pronounce with certainty as to whether there may not be some faults, slips, or inversions, amongst the strata which have not yet been observed: there is no evidence that there are—my conviction is that there are not any of these things to be met with from side to side of the island, and under this hypothesis, there are at least six separate deposits of sedimentary matter cropping out betwixt Love Grove and Sewree, a distance of five miles across the surface, or of probably less than half a mile, say two thousand feet, in a line at right angles to the plane of the strata. It is very probable that it is to the alteration of beds of trap and sedimentary stata arranged horizontally or nearly so that the remarkable stratified appearance which renders the mural precipices of the western ghauts so picturesque, is due. The uncertainty as to the number of separate beds is increased by finding one of these at Sewree divided into two by the intrusion of a mass of trap in the middle of the bed, and similar things may probably be found to have occurred more than once.

41.—I have assumed the beds which protrude from under Malabar

* "The Island of Bombay is composed of five or six bands of trap rock, chiefly greenstone and amygdaloid, and conformable, and diping west, at about 10° or 15°, and separated by beds that have the appearance of being of sedimentary origin, though there is no actual proof of the fact."—Clarke on the Geology of the neighbourhood of Bombay. Trans. of London Geol. Society, vol. III. 1847, p. 221. "There is now, as will be seen, great abundance of proof, not only of the sedimentary, but of the fresh water, origin of all the beds."—Falconer's Account of Perim. Geol. Journal.—Dr. Lush considered the sedimentary rocks of Bombay above the trap—they in fact alternate with it.

Hill to be an extension of those seen at Mahaluximee, at Love Grove, and again at Worlee; from the wood stacks to the base of Tardeo Hill, and again from Mahaluximee to close by the sluices, and in a straight line from this to the extreme end of Worlee Hill, the rock is hid under alluvium, and there are various similar beds close at hand. So far as the outcrop is visible along the seashore, the beds under Malabar Hill are of a pale ochrey yellow: they dip at an angle of about 15° W. and by S., and seem about forty feet in thickness, conjoining the perpendicular scarp in the cliff with that showing itself horizontally under the tide. The upper beds, as exposed are much less friable than the under ones. Some feet below the trap large compact masses, containing small scales of mica, have been met in with: some of these are perfectly black, charged with carbon: when freshly broken they smell strongly of naphtha, and might readily be mistaken for strata of the coal formation. Some of them abound in small crystals of sulphuret of iron, supposed by the natives, when first found, to contain gold. Impressions of reeds and grasses are found in abundance both on the black and yellow shales—I have not met with any other remains, but have no doubt that they exist in abundance. The beds first show themselves about half a mile inland from Malabar Point, where they emerge somewhat suddenly from under the basalt—they are not traceable on the other side of the hill. They continue along the line of the public road and sea shore for about two miles, when they are buried by the marine deposits from the wood stacks up to near the Gowalla Tank. Here I have met with them in the bottom of several wells near the country residence of Juggonath Sunkersett. They are once more lost sight of till seen again in an excavation at the edge of the flats opposite the Bee Hive near Mahaluximee and near the velard; and just on the seaward side of this, on the beach opposite the residence of Sir Jamsetjee Jejeebhoy, the strata are seen set on edge striking out betwixt two beds of trap till they thin away into a point. The bed re-appears in the same line as that in which it is last seen, betwixt the sea and shingle beach below the low precipitous cliff under the temple of Ram Hill, which forms the southern part of the Love Grove group of eminences. Here the strata are nearly horizontal, the colour of the rock a somewhat brownish yellow; the mass visible is about three feet in thickness. Both towards the land and round by the seashore,

it disappears under the basalt, and continues for half a mile invisible. It re-appears for about thirty yards on the seashore, about half way betwixt Mr. Smith's house and the sluices. Here, where the covering of basalt is awanting, it has been pierced by a well, and water found in abundance.

42.—2. *Love Grove Beds.*—The extensive cutting for the debouchure of the Town Drain, at the sluices near Worlee Hill, affords a beautiful section of the trap and stratified rocks. The general level of the island is so close on that of high water, that a canal two miles in length required to be cut before a proper point of discharge could be found for it, and here a cut thirty feet across, 1,000 in length, the continuation of the canal to seaward, and sixteen in depth, required to be made, to enable it to secure sufficient scour from the sea. The cut traverses a little natural valley, betwixt a hillock of basalt, part of the Love Grove ridge, and the southern end of Worlee Hill. The stratified rock along the valley appears at the surface, and is seen to descend at both sides under the trap, dipping to the W. and by S. at an angle of about 12°, in a tolerably even plain. The upper beds are of a dirty yellowish colour for about from one to two feet down: to this a mass of perfectly black strata, highly bituminous, succeeds. It smells strongly of coal tar when fresh broken, and smokes, loses weight, and changes colour, in the fire. It abounds in impressions of reeds and grasses, and here also skeletons of frogs and tortoises are to be found.† Just at the sluices the regularity of the beds has been disturbed, and they dip for a little in all directions. Here they are surmounted by a large mass of basalt, rising into a little hill: more towards the sea they crop out again, the basalt disappearing,—and from high water mark out to sea they are covered over with a mantle of basalt broken into fragments, and from two to four feet in thickness: and this state of matters continues till the rock disappears under the ocean. The lower beds of these strata are full of nodules and septaria, and seem to have been much disturbed in comparison to the

† "The batrachian beds are a mass of blue rock [those under consideration] weathering into shale not unlike ordinary coal strata, containing what I have no doubt will turn out to be vegetable impressions. The upper beds are interstratified with thin seams of sandstone and argillaceous rock, and over the whole is a mantle of basalt, which cannot be less than seventy feet thick. This basalt has in parts caused imperfect fusion of the fossil beds, obliterating their stratification, and superimposing something of its own columnar or at least prismatic character."—Mr. Clarke. Proceedings of the Lond. Geol. Society, 6th Jan. 1847.—All this is in perfect accordance with my own observations.

upper or rather the middle strata, which look as if laid down in a state of great repose; and the cause speedily becomes apparent. Just to the northward of the great cut, the stratified rock has for a short distance been peeled off by the sea, and the trap under it exposed to view. Its surface is corrugated and furred in all directions, consisting mostly of globular or highly vesicular masses, with every here and there pieces of semifused strata, showing clearly that the sediment had assumed its position when the melted matter impinged on it from beneath, the trap itself becoming greatly affected in its external character by the cold material with which it came in contact, while the sedimentary deposit was partially fused or chertified by the fiery mass. The stratified rock re-appears again all around the end of Worlee Hill, facing the sluices, and presents itself for a few scores of yards both along the high road and seashore, to the northward, where it is once more lost under the basalt. Here, however, the stratified cliff is about six feet in height—the rock has been melted both above and below, showing that the trap from beneath, and that above, were both hot when they impinged on it. It has at one point been much disturbed by some agency coming into operation after the fused beds had become rigid, and which thus forced the zigzag fragments of chertified rock into the middle of the mass. The fossils in this bed were first discovered by Dr. Leith in 1846, when the engineering operations were in progress, as referred to by Mr Clark. Just as I had nearly completed the preparation of this paper, an essay on the Geology of Bombay was read before the Bombay Branch of the Royal Assiatic Society, (December 11, 1851,) by Dr H. J. Carter, from which I take the following extract:—

"The author stated that the Island of Bombay, though unpromising in aspect geologically, was nevertheless of extreme interest in this respect. That although at first sight it might appear to be nothing more than a mass of black trap, yet that nevertheless it presented in its composition the three classes of rocks, viz., Igneous, Lacustrine, and Marine.

"That there was distinct evidence of successive effusions of the igneous rocks, and that they had been thrown up through the lacustrine strata, which were of ancient date, and had thus again been brought to the earth's surface and exposed to view.

"That the latter were deposits of fresh water, there could hardly be any doubt left, since to the author's knowledge no marine fossil had been found in them, while they abounded in lacustrine ones. Dr. Leith had discovered in them two species of reptiles belonging to the Chelonian and Batrachi an orders; the former consisting of fresh water tortoises, of which he had found specimens of nine or ten individuals bearing the distinguishing marks of the Pleuroderal Elodians or Marsh

tortoises, and the latter of frogs, of which he had found numbers in two separate places widely apart: the latter had been called by Professor Owen, *Rana pusilla*. Entomostraceous Crustacea of the family Cypridæ prevailed throughout these lacustrine deposits, and in some parts strata were wholly composed of the shells of these little animals: there were the remains of several species of them:—one ovoid and granulated on the surface, another cylindrical, and a third discovered by Dr. Leith which had a striated rim round the large end. The author had also found several small seeds, and Dr. Leith again had discovered leguminous pods like those of the tamarind tree, with roots and stems of aquatic plants, which with pieces of various kinds of wood abound in the lower part of these strata in a bituminized or anthracitic or coaly state, giving the whole a black carboniferous character. No positive evidence of shells had yet been met with, but the author had found in a black chertified portion of the upper part of these strata the section of a fossil which could hardly be taken for anything else but the remains of a shell resembling a Paludina. All this proved that these strata were purely lacustrine, and hence it followed that in the position now occupied by the island of Bombay, that is so far as latitude and longitude are concerned, there was once a river or fresh water lake; but it by no means followed that this lake should have been on a level with the sea, since the author had shown in his 'Memoir on the Geology of the Southeast Coast of Arabia' that that shore at least of the Arabian Sea had undergone an elevation and depression of more than 4000 feet.

"Next to the Lacustrine strata in interest, perhaps, was a rock which had been called 'Conglomerate,' 'trap tufa,' &c. This appeared to be an igneous one, which had been altered by its passage through aqueous strata and formations containing much iron. The presence of large angular portions of aqueous strata proved this, and the heterogeneous admixture of igneous and aqueous rocks in the greater part of it made it closely resemble in composition the *Rothliegendes* of the New Red Sandstone Series, also called 'Exeter Conglomerate;' while its argillaceous nature in some parts, mottled red and white and always highly ferruginous allied it with the foregoing characters so strongly to the Laterite, that the author conceived them to be one and the same formation. There had been two or more effusions of it, because dykes of it were seen passing through masses of the same material; the hills at the northern extremity of the island were composed of it: it might be seen following the course of the lacustrine strata imbedded in the diorite, and bursting through the latter in several places."

43.—The yellow sedimentary beds continue traceable all along the landward base of Worlee Hill by the public road, occasionally manifesting themselves on the sea shore. A bold promontory of hard compact basalt runs out to seaward from the fishing village of Worlee: just behind the fort, close by the beach, there are six or seven wells, nearly adjoining to each other, all cut through the stratified rock—they are all old and moss grown, and all I could determine of the strata was that they dipped at an angle of from 10° to 12° nearly due south. From this onward to the estuary at Mahim, the rock sinks beneath the level of the sea, and is covered over by littoral concrete. The basalt, as already stated, re-appears at Bandora, and forms the promontory and ridge of Nossa Senora de Monte. The rock to the eastward of this seems mostly tuffaceous, and is, very probably, the

of Luximon Hurrichunder, and of Parell Hill; along that of the Agricultural Society, and thence along the upper slope of the valley towards the old Artillery grounds at Matoonga, being discernible in the tanks and wells as we proceed, to where it is hid under alluvium. The lower portions of this beyond the Society's Gardens are of a blueish colour, and seem to have suffered much from crushing and lateral pressure.

48.—Under the Chinchpoogly Hill is a large mass of fine even-grained compact trap, which forms the ridges just to the eastward, one to the south of the Society's Gardens, on the highest point of which my house is built, seventy feet above the sea.

7.—*Sewree, or lowest Sedimentary Rocks.*—The *three* sedimentary beds at Sewree are so closely contiguous to each other that I have treated them as one—two of them being very obviously a single bed split into two by the intrusion of trap.

On cutting down the cliff betwixt my house and the sea with the view of obtaining material to fill up the reclaimed ground for a site for the works of the School of Industry, and a position for a brick field, the following section was disclosed: a fragment only is here given to illustrate the text—it will be found represented in full amongst the lithographs at the end:—

49.—The face of the rock here represented is about thirty feet from *c* to *g*—from *a* to *g* gives a cross section of this as seen in a well partly re-opened, partly sunk six feet under the level of *c*.

50.—The burst of the Trap through the whole three beds of stratified rock I had unfortunately no means of tracing lower down, or further out, than is here represented. The stratified beds were examined a little out to sea, and found unbroken, so that it did not extend as a vein further in this direction. The melted matter has here split one large mass of strata into three, pressing them down, and distorting them, as above exhibited—the proof of the intrusion rests on this, that the upper surface of *c*, and lower one of *e*, are completely melted, the stratified portions being in general from two to four inches in thickness, sometimes as much as eight or ten at the sharp salient angles: the same seems the case with the upper and lower beds of stratified matter, but there it is not so obvious, the beds being much less perfectly exposed. The stratified rock abounds

in marks of reeds and grasses—I have not met in with any animal remains. The seventh of the beds can be traced for about 200 feet to the south, and 100 to the northward of the rest: here my operations ceased—beyond this the strata are conspicuous, but the intruded trap is no longer traceable on either side. The whole mass is surmounted by a cap or mantle of greenstone forming the ridge on which my house of Balcairn stands, and that running along to the east of the Society's Gardens. It is tossed about and then tilted up about 400 yards to the southward of my house, the crop retiring from the sea shore, and crossing to the westward: to the northward again the beds exhibited by the edge of Sewree Hill, and all across the village of Sewree up to the base of the chert rock (44) on which the fort is built, itself obviously a mass of fused strata, probably of older date and lower position subjected to a much higher temperature than that by which the external crusts of the other beds have alone been affected, the yellow stratified mass under discussion (I shall come to the Sewree Fort chert by and bye) is found in wells all along the back of the village and fort, and so in others along the line of the public road at the base of the hill to the westward. This is surmounted by a mass of trap some forty feet thick, when a second bed follows this up to the eastward. It is traceable along the face of the hill from the Police Chowkee to where the Parell joins the Sion and Matoonga road, and here it has everywhere been pierced by wells, and abundance of water found. I am not prepared to say whether the trap has been here intruded or not amongst pre-existing beds, or whether there be two independent formations, or one split in two. The two just examined seem to unite about half a mile further on, where they are either joined or closely approached by that already described as the Chinchpoogly and Parell Hill bed, and passing through the valley of thegardens. The rock is from henceforth covered over by a thick mass of marine alluvium. All these beds, especially the lower ones, are remarkable for the abundance of water contained in them—the outcrop of that next to or beneath the level of high-water mark may be traced for more than a mile by the dampness of the ground, or the grass and rushes that present themselves at the surface, a large growth of which makes its appearance all along the sea shore. In a break during the rainy season after a week of fair weather, when there is not a drop of superficial

water flowing, a flow proceeds from them which forms a considerable rivulet from fifty or a hundred feet of outcrop. Of this I shall have occasion to speak more fully when I come to treat on the subject of water. These beds I believe extend over the whole length of the island, and probably into Salsette : they are generally hid under alluvial matter, and the wells in this quarter are few in number, and mostly old.

THE CHERT DYKE OF SEWREE AND MATOONGA HILL.

51.—Unless very closely examined, the black rock which constitutes the promontory on which Sewree Fort is built may be mistaken for basalt, similar to that of Malabar Hill : a narrow inspection discloses the unexpected fact that it is black jasper or Lydian stone—it has the same specific gravity as jasper, strikes fire with steel, is luminous when rubbed in the dark and gives out a strong sulphurous smell—it scratches glass, and breaks with an uneven conchoidal fracture. It still shows considerable traces of stratification, especially towards the northern end of the mass; the dip is at an angle of about 25°, or double that of the rocks adjoining, and it is split across into semi-prismatical masses. The Sewree mass is about 200 feet across, 1000 in length, and 40 or 50 in elevation. It suddenly disappears on the verge of the salt pans, but a thin vein of it can be traced for nearly two miles to the north-westward, where it reappears in mass, forming a considerable hill to the southward of Matoonga burying-ground, on the margin of the creek betwixt the rice fields and the salt pans—beyond this I have not been able to trace it towards Sion. The rock decomposes very slowly, and affords a poor arenaceous debris: its surface yields scarcely any sustenance to vegetables—the palmyra is the only tree that grows on it, and the short grass which covers it during the rainy season vanishes on the return of the dry weather. It is too hard for a building stone, and too sharp and splintery and difficult to bed for road metal. The heat to which it has been subjected has nearly obliterated all traces of stratification, and of course extinguished every appearance of organic matter. It seems as if it were the remains of beds lower than any we have described—subjected to semi-fusion, and forced up from beneath. Betwixt this and the island of Trombay is a sludgy creek, here nearly three miles across, and

there is about an equal expanse of rice-fields, before the first rise of the Neat's Tongue is attained: what rocks may prevail under these, it is impossible to discover.

TRAP AND PSEUDO-TRAP ROCKS.

1.—Basalt.—2 Greenstone,—upper and lower Beds. Porphyry. Amygdaloid.—3 Trap-Tufa.

It is in all likelihood to the singular interminglement of volcanic and sedementary formations that the vast diversity of trappæan rocks in the island and its neighbourhood is due. In the topographical description of Bombay, I have already given a general account of the basalt and greenstone beds. It is next to impossible to preserve clearness in this matter without some chance of repetition;—these risks I have incurred as less annoying than the obscurity likely otherwise to arise. I have marked off the paragraphs of these papers by numbers, with the view of avoiding this as much as possible.

1.—Basalt.—The Basalt formation, as already stated, forms a vast sea-wall from Malabar Point as far north as Bassein. The rock is almost perfectly black; its specific gravily is 2·882: on the face of Malabar Hill overhanging Back Bay it is columnar, and magnificent masses of basaltic columns present themselves under high-water-mark nearly half way between Back Bay and Colaba. They rise from three to five feet above the surfaee of the sand, and consist generally of four, five, and six-sided prisms from one to three feet in diameter. On the Western side, where the mass appears to be overlain with sedimentary rocks, on Malabar Hill (See Section 8) the columnar form disappears, and the basalt assumes that tuffaceous character generally presented by it when nearly in contact with stratified rocks. Opposite the temple of Mahaluximee the basalt is tabular, and presents us with a regular exhibition of strata dipping at an angle of 8° or 10° S. W. On careful examination no trace can be found of a sedimentary origin for these. The mass is generally ill supplied with minerals, in this respect contrasting strikingly with the greenstone of the Island. At Versova, as already stated, it is highly porphyritic. (See para. 10.) There is a beautiful group of small sized basaltic columns near the road betwixt Chimboor Ferry and the village of Trombay on the island of that name. They are perfectly black, well formed, and from 8 inches

to one foot in diameter. On the new road to Tanna, near to where the Railway crosses it, a fine mass of columnar rock is met with, of a pinkish yellow colour, apparently compact felspar. It rises in masses so regular as to be employed in the railway works without further dressing. It seems to extend in both directions, and probably forms considerable part of the Mountain of the "Neat's Tongue"; and it exhibits itself in the opposite direction in the mass of horizontal columns near Powie in Salsette.

2.—Greenstone. The position of this species has already been described (see. paras. 12 & 13); and a vast number of varieties of this rock are to be met with in the island. It is usually found in large masses divided vertically from each other by veins of great size,—these veins being filled up with red or yellow earthy matter, the results apparently of decomposition. Occasionally it is found in globular masses, the globes varying from a few inches to several feet in diameter: they split into coats by decay; the centre portion being generally hard, black, and crystalline. Masses of trap of this sort are frequently found embedded in a stratified matrix, itself occasionally slightly porphyritic; and where these are exposed to the action of the sea and weather alternately, the appearance presented by them is curious and grotesque in the extreme. (See Plate.)

The upper portions of the Greenstone rock are generally hard, brittle and crystalline, difficult to work, considerbly darker than the portions beneath, and held in small estimation by the builder and the quarryman. The rock presents the same general appearance, before being broken, as that just underneath. It seems, when split, as if the superficial melted matter had been suddenly chilled to the depth of three or four feet,—that below having annealed and softened by gradual cooling. The lower greenstone is of a fine rich gray colour: the tint is uniform when first broken, but when exposed for a few weeks to the weather it becomes darker and marked with small spots, exactly as if a slight sprinkling of rain had fallen upon it,—the finer portions of the stone being known to the builder as rain-drop rock. It breaks up in masses of any size short of a cubic yard; and lintels and columns, four or five feet long, can be split out of it by the use of the wedge alone. It is easily dressed with the hammer and chisel; and but for the tint, which becomes nearly black when exposed to the weather, it can

hardly be surpassed as a building stone : near Parell there is a light blue variety of trap of a soft earthy aspect, which easily yields to the stonecutter : it looks more like hardened mud than volcanic rock. It corrodes when exposed to the weather, and is unsuitable for building purposes unless under ground. Near the line of railway opposite Parell, the greenstone assumes a dirty olive brown appearance, and contains immense nests and veins of calcareous spar, sometimes of very great beauty. It is here slightly porphyritic. At the Western base of Chinchpoogly Hill the greenstone is of a pinkish ochrey hue, and might be mistaken at a distance for Oolite, or sandstone of the coal formation. It closely resembles the compact felspar of Fifeshire in Scotland. As a building stone it blackens in the weather, but is not subject to decay.

Greenstone, Porphyry, and Amygdaloid, are found together in abundance to the north of the gardens of the Agricultural Society,—near the Baboola Tank,—and to the northward of Parell near Matoonga. They abound in minerals often of great beauty ; and wherever, in fact, the trap and stratified rocks approach each other, the character of the former becomes vessicular.

3 Trap-tuffa.—It is difficult to class and describe our trap tuffas, diversified and irregular as they are, and presenting themselves mixed up in the most intricate manner with the more compact of our volcanic rocks. One of the most prevalent varieties of Tuffa consists of olive greenish or brownish coloured masses, imbedded in a matrix somewhat darker in colour than themselves. It abounds in calcareous spar in veins and nests. When fresh broken it seems like a plum-pudding-stone of uniform hardness and durability ; when exposed to the weather the matrix is rapidly decomposed, and the rock becomes cavernous like some varieties of lava ;—the imbedded mass resisting decay while the matrix disappears. It is to be found from the base of Nowrojee Hill (see para. 14) to the Chinchpoogly Salt Pans, and is most conspicuous just opposite " the Mount," and along the north side of the Powder Works compound. Another variety of the trap-tuffa, probably consisting of this though it differs from it in point of aspect, prevails in the flats to the eastward of Mr Dickinson's house. The embedded masses are whitish, pinkish, greenish, and gray. Where the public road crosses from Sewree to Parell, at the base of Flagstaff

Hill, a vast mass of tuffaceous rock, almost white, prevails. It is full of veins and cavities usually filled with spar. The cavities are of an oval or amygdaloidal form, the longer axis in all cases being from N. E. to S. W., as if the rock, while still in a soft state, had been compressed laterally from S. E. to N. W. The cavities are, for the most part, filled with siliceous spars and veins, and coatings of agate and chalcedony. The rock blackens very rapidly with the weather, and its real character is only known when freshly broken. I mistook it, for a while, for common greenstone. Where it is uniform in texture, it is cut up for water troughs and aqueducts, being soft when first exposed to the air, and hardening afterwards without abrasion or decay,—in this respect resembling laterite. A purple variety of tuffa, differing altogether from this, is to be found in the hills between Sion and Matoonga. The prettily wooded hill, on the base of which stands the powder Magazine, is composed of it; and it has here been well exposed to view by the operations of the quarry-man.

Further to the eastward, white coloured masses, marked with small ochrey spots like porphyry, are embedded in it; and in detached pieces, on the seashore, I have found this passing into laterite. After most careful enquiry I have failed to find the two rocks in contact to determine the fact, which seems more than probable, that they pass into each other.—In nearly all these Tuffas beautiful specimens are found, either of trap which has been disturbed in its viscous state while cooling, or of sedimentary rock which has been slightly fused without becoming either jaspideous or having its texture obliterated. I have not been able to determine which of the two is the correct state of matters, or whether both may not be found occasionally to prevail. The rugged masses of Tuffa are occasionally seen coated with this,—occasionally found running in long thin beds with other rocks:—but the trap rocks of Bombay would, of themselves, furnish a cabinet, and the subject of an essay, which could only be properly understood when read with access to the specimens,—a condition of things attainable only to those who have searched every quarry and excavation on the Island.

Lines of Junction.—It will readily be imagined, from what has been already stated, that very striking appearances are to be met with at all the lines of junction; and it is matter of regret that so few opportuni-

ties present themselves of having these carefully examined. I have already instanced the case at Sewree, where so beautiful an example presents itself between two beds of stratified rock, fusing the upper part of the lower, and the lower surface of the upper beds, into a hard flinty matter. Generally speaking, however, the sedimentary rock has been but slightly altered. At the line of junction, at the Baboola Tank, all the most beautiful of the minerals are to be found, and here cavities and veins of spar are occasionally to be detached in the semi-fused stratified rock. The trap just under this is full of cavities with veins of from a few lines to half an inch in diameter, running downwards sometimes for several feet, when they disappear; and this holds also along the face of the rock at Nowrojee Hill, and in the wells in the Jail compound,—and probably at every point throughout the island where the stratified rock and trap meet together without disturbance. The lower strata of Baboola Tank and Nowrojee Hill are very little affected by the volcanic matter, the carbonaceous matter still remaining in them in abundance. Along the line of Railway the two varieties of rock are so confused and intermingled that it is difficult to see where the line of junction occurs, a mass of tuffa intervening which seems sometimes trappæan, sometimes sedimentary. It may be laid down as a general rule, that where trap has been forced upwards, and has affected the sedimentary rock, it has itself always been much altered, and rendered cavernous and irregular. This is readily observed at the sluices and at Breach Candy, where the denudation has left its surface exposed.

SUPPLIES OF WATER.

When it is considered that the annual evaporation over the island amounts to about 70 inches, or close upon the average of the annual fall of rain, and that for eight months during the year scarcely a shower ever reaches us, the capacity of the Island of Bombay for preserving water (adequate to the supply of nearly half a million of people located close together upon little more than ten square miles of ground) must be very remarkable. Our Marine and fresh water formations seem to constitute reservoirs; the volcanic rocks preventing easy exit, and to some extent cutting them off from the sea. The basalt is nearly destitute of water, although wells are now formed in it in abundance on

the eastern side of Malabar hill, by penetrating through the volcanic rocks to the sedimentary beds below. The greenstone affords abundance of wells, though it is always uncertain where the water may be met with: it seldom indeed makes its appearance till either a stratified rock has been encountered, or we have reached the level of the sea. In the litteral concrete water is found in profusion everywhere, though it is apt to become brackish after blue clay has been passed through. It is probably on this ground in some measure that the sites of the Fort and Native town were selected: here the marine or the fresh water formation is found to prevail, and wells are to be met with in hundreds in close contiguity to each other. It is a curious fact, that in this case the water generally rises and falls with the tides. It is only close to the shore where these fluctuations can be observed daily; but at the distance of half a mile from the sea they are easily discernible at spring tides, occurring for the most part when the springs begin to fall off. I have not been able to discover that the quality of the water is sensibly affected by this, and it would seem to be occasioned by the ponding back of the usual discharge from the shore to the sea. There are scarcely any wells in the island of Colaba; the only one, in truth, which contains water permanently, is that of the Observatory compound. This is about 30 feet in depth it extends about 10 feet below high water mark, and it affords a permanent supply to about 300 people, yielding on the whole about three hundred gallons per day towards the dry season. The water is pure and of excellent quality. The wells around dry up in March. Several wells have been recently dug through the stratified rock, near the Pilot's station, and Colaba Church, which are well supplied with water. Others have, of late, been excavated through the trap near the Gun-carriage Manufactury which promise to be productive. The Esplanade, Fort, and Native Town abound in wells which are well supplied with water. Along the line of the Sea shore fresh water is to be found all the year round, within fifty feet of high water mark and ten feet of the surface; and the occupants of tents may always supply themselves by making a hole a few feet and deep, lining it with a couple of beer barrels. By far the finest reservoir is Baboola Tank, near the Grant Medical College, originally a quarry and still from time to time deepened and enlarged for the sake of the stone it supplies. It is of 1050 feet in length, and 450 feet across, and it

contains, when full, nine million cubic feet of water. Within a couple of hundred yards of this, a magnificent tank, thirty feet in depth, and one hundred and fifty feet each way, has been excavated by Sir Jamsetjee Jejeebhoy, expected to contain 400,000 cubic feet of water. When almost completed it was discovered that a great rush entered it near the bottom, and the water so brackish as to be useless except for bathing purposes, containing half the salt of ordinary sea water, though at a distance of more than half a mile at the nearest point from the sea. It is probable that this may either be built out or got rid of by other means by and bye. It is a singular fact that it should appear in such profusion, evidently not coming directly from the sea from its modified degree of saltness; yet from its uniform flow at the driest periods of the year, being derived apparently from some ample but tainted source of supply. Nearly all the wells in the Flats are more or less brackish, as may be expected from the amount of salt with which the clay around is impregnated. From Matoonga to Sion, over a large tract of ground, water is generally to be procured at a depth of from ten to twenty-five feet; and it gives us a sad view of the neglect of agriculture on the island that, with a rich soil and a profusion of manure and water, the land should remain barren for eight months of the year, the cultivator being content with a single rice crop raised during the rains. The vegetables and fruits in most demand in Bombay are all brought from Salsette, or the islands to the north of it,—reversing in this way the usual economy of countries where agricultural productions of difficult transport are raised in the neighbourhood of the point of consumption; the rice and grain, which may be carried at a moderate charge, are grown close by, while vegetables are brought from the interior, and the state of matters prevails up to the very enclosure of the gardens of the Agricultural Society. A regular register of wells is kept by the Board of Conservancy, and a return of their condition made periodically to the Magistrate of Police. Some years ago a chemical report on their waters was prepared by order of the Medical Board; and an extension of this, so as to include all the wells of the Island, would form a very valuable document.

Calcareous and siliceous spars are the most abundant, of the Minerals found in Bombay, some of the latter being found in great beauty in quarries near the Railway, near Parell, in Baboola and Pydonee Tanks

inthe native Town,—of which I have been fortunate enough to obtain a magnificent collection of Minerals, of the Zeolite family, the finest of which were laumonites of most singular beauty. The Crystals of the different minerals often lie over each other, layer above layer; in one instance a specimen of perfectly transparent selenite found in a cavity, and trap is partly covered over with crystals of calcareous spar and apophyllite.

With the exception of laterite (referred to at length hereafter) I am not sure I can venture on enumerating any of the exogenous rocks found in Bombay as strictly speaking transported. Granite, quartz, and limestone, in a variety of forms, are to be found on our shores, but the great bulk of them appear to have come as ship ballast; and I have found none so situated as to warrant the assumption of their deposit there by natural causes.

PAPERS ON THE SUBJECT.

AN ACCOUNT OF THE GEOLOGY OF BOMBAY was published in 1836, in the Madras Literary Journal, by Dr. Thompson. It is meagre and imperfect; and he makes no mention of the stratified rocks which form so important a characteristic of this part of the Konkan. There is a paper by Dr. Lush, in the Transactions of the Bengal Asiatic Society for 1834, on the Geology of the Northern Konkan, in which there is a short notice of Bombay to be met with. He assumed, as has already been seen, that it was a single mass of stratified rocks, and that this lay above our traps. Mr. George Clark gives, in his notice of the Geology of this neighbourhood, a short but clear and correct outline of the fresh water formations of the island; and this is all of which I am aware that has been published upon the subject. The present paper owes its origin to some experiments to reclaim the flats, in which I was engaged from 1846 to 1848, and of which an account was desired by the Court of Directors; and to the excavations on my own grounds in preparing a site for the School of Industry at Sewree.—The spectacle of some thousands of acres of fine promising ground, just in the neighbourhood of half a million of people, with an unbounded supply of manure and fresh water close at hand, seemed so singular that I determined to make the experiment of washing out the salt which rendered the flats unproductive, and to endeavour to bring them into garden cultiva-

tion, introducing in the course of these works the use of the windmill, a variety of implement promising to be of inestimable value to us, but utterly unknown in India. For these ends I obtained a Grant from Government in 1846 of a space sufficient for the experiment, and enclosed it with an earthen mound close by the Town Drain, from which I proposed to draw water during the rainy season to wash out the salt, and liquid manure during the rest of the year, with water as might be required to fertillize the ground. Difficulties presented themselves in the way for which I was not prepared: I was less successful in the windmill machinery than I had expected; and the time I could devote to these matters was so exceedingly small that nothing conclusive had been done when it was resolved to admit the sea water into the Town Drain to carry off the nuisance it occasioned, so as to put an end to all my expectations of success. The Court of Directors had called for an account of the Experiments; the explanations of the source of my expectations and the grounds of failure could not be made complete without a Section on the Geology of Bombay. This was forwarded through Government in June 1850. As I had heard nothing of its having reached its destination, I availed myself of the unusual advantages presented by the droughts of April and May 1851, and the works then in progress, to correct and enlarge the paper and to cast it into its present form. My friend, Dr. Henry Carter has, it appears, been meanwhile engaged in a similar enterprize. I was not aware of his having written on the subject till his paper was laid before the Asiatic Society in December; and although I have no doubt of its great superiority, in paleontological and mineralogical matters to anything I have produced ont he subject, my conviction is that the views we are likely to have taken are so different that both papers may prove acceptable in the Transactions of the different Societies of which we are secretaries, respectively. His Essay, in all likelihood, deals with scientific and speculative enquiries, while mine treats of economic Geology. I have been, purposely, as minute as circumstances permitted, deeming it expedient that everything in the shape of fact, referring to local phenomena, however trivial, should be placed on record in the transactions of a local Society; leaving the reader, afterwards, to select those things that are important from those which may appear more immaterial. To the English reader it will appear singular that, after all, so little should be known of the

Geology of this locality—so limited, yet so interesting. It must, however, be remembered, that though the population is large, the number of Geologists is small; that those who have most leisure at their disposal are not always inclined to employ it profitably; while those who would make the most of their time, had they any to spare, are occupied by the duties of their professions. The climate, too, only permits of a few hours in the morning or evening for out of door occupation: the rainy season for four months seals up the surface of the earth from observation altogether; and unless sections be made while the excavations are in progress, during the months of April and May, the opportunity is lost by the exposed rocks being encased in building, or concealed by debris or vegetation.

Although we have been digging wells, making cuts and excavating foundations, for more than a century, yet no record appears to have been ever kept of the material encountered; and the Board of Conservancy is, at present, as much in the dark as the original Portuguese conquerors of what material they are likely to meet with when they commence operations in excavating a well. It is to be hoped, Dr. Carter's paper and mine will, between them, furnish a foundation, at all events, for the labours of future Geologists. I am willing to begin and to acknowledge the imperfections of my performance, rather than run the risk of waiting until I should be able to make my task complete.

I have stated that some of the most interesting sections were obtained while preparing a site for the School of Industry at Sewree;—and I trust I may be pardoned if I mention, with no small degree of gratification, that the colouring of the drawings have been all executed by my convict pupils.

NOTE A. p. 177.

EVIDENCES OF A GENERAL VIBRATION, OR DESCENT AND SUBSEQUENT UPHEAVEMENT OF THE LAND ALL ALONG THE SHORES FROM SUEZ TO ARRACAN. (THIS NOTE REFERS TO P. 178. THE QUOTATION HAS BEEN OMITTED BY THE PRINTER).

WHOEVER has read the previous paper on Volcanoes will already have seen that the upward and downward movements, on our shores, have been phenomena of frequent, and some of them, of recent occurrence. We are not assured that the upper part of the Bay of Bengal, as high as Chittagong, was effected by the same series of convulsions, as on three successive occasions lifted the Tenasserim shores and the islands of Cheedooba and Ramree into terraces; but there is the strongest possible presumption that it was so. Ten years after the occurrence of the last of these we know that Chittagong and the surrounding country were depressed, so that we have precisely similar movements as those about to be described, only that the last of the series had been inverted in point of order; the upheaving taking place first and the depression following, instead of the depression occurring first and the upheaval subsequently. In the frequent borings for water which took place at Calcutta, between the year 1804 and 1837,—during which time the ground had been penetrated to depths from 70 to 380 feet,—a succession of strata were met with, indicating most clearly that that portion of the delta had been alternately a salt marsh, covered with mangroves, and a fertile plain watered by rivers, and on which deer and other wild animals were able to sport and browse. The existing site of Calcutta, little as it is elevated above the level of the inundations, could only have attained its present altitude by upheaval. Whenever ground reaches the limits of ordinary floods its rise becomes almost imperceptibly slow: when it gets beyond the level of extreme inundation it can never rise at all, save by force from beneath. Appearances, the same as those found at Calcutta, were found in boring at Madras; and beds of shells, covered with recent alluvium, are found at the present day, all along the the level portion of the Coromandel Coast. At Madras itself this has, of late, been transformed into selenite; at Bombay into masses of calcareous spar. So far back as 1797 Captain McKenzie called attention to the terrace of sea gravel and shells bordering for the space of 500 miles the low flat shores of the Carnatic, as an evidence of the recent recession of the sea ——the theory until lately very generally maintained; and all along the shores of Manaar the same phenomena were observed——the cemented shells (littoral concrete) forming a portion of Adam's Bridge. It appears more than probable that the bulk of the Islands which skirt the Malabar Coast were, at no

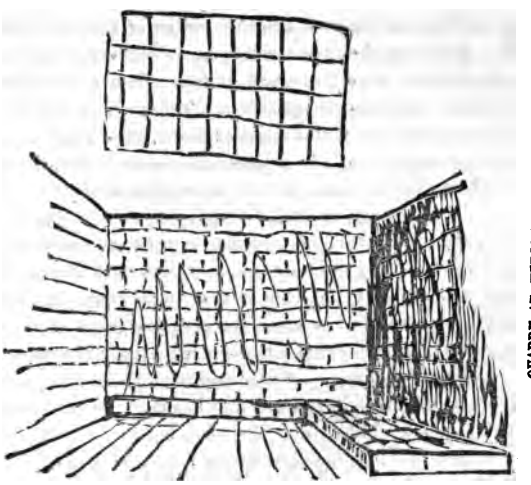
very distant period, under water. The state of matters at Bombay itself has already been explained. The Deltas of the Taptee and Indus have, obviously, very lately emerged from the sea, while the whole of the Arabian shores, from the mouth of the Persian Gulf to the Straits of Babelwandeb, are described as covered with recent sea shells, and as being very obviously a raised beach. Dr. Carter describes a cavern near Ras Morbat, the floor of which is a few feet above high-water-mark, the roof being 30 feet high, obviously excavated by the waves. The face of the cliff on a level with the roof is full of the borings of lithodomi, and Dr. Carter supposes that the cavern was excavated while the cliff was slowly emerging from the sea. There are many similar caverns in the interior: the roofs of all are encrusted with sulphate of lime as stalagmite and stalactites. The Runn of Cutch is believed by the natives, to have been at one time an inland sea, freely accessible from the main ocean, while an extensive commerce prevailed along its shores and large sea port towns, with considerable harbours, existed at places now considered as far in, in the inteior. In proof of the probability of this, it is maintained that enormous pieces of iron and ship nails were thrown up from the Runn of Cutch during the earthquake of 1819. It is perfectly ascertained again that, during the earthquake referred to, the level of the Delta of the Indus was considerably depressed, the bed of the Runn having sunk no less than seven feet. These movements are strictly analogous to those already referred to, as having occurred in the upper part of the Bay of Bengal, in the middle of the last century. I am in possession of the grinders and some of the bones of an Elephant dug up from 8 feet below the surface of the earth in digging a well near Kurrachee: they were entombed in the blue clay formation. So late as the period of the Portuguese supremacy, says Kennedy, in about the middle of the 17th century, the navigation of the Indus was perfectly safe, much higher than vessels can now reach; the port of Tatta forming a place of resort for square rigged vessels of 40 guns, the remains of one of which is now to be found in the plains near Vikkur, while it is well known that no vessel, of this size and form has, for the last thirty years approached the Shores of Scinde. Mr. Cubitt found during his investigations, with a view to the construction betwixt the Mediterranean and Red sea, that the assumption of a difference of level between the two, made by the French Engineers, was fallacious; and that so far as could be ascertained the level was nearly the same in both. It appears that six centuries before the Christian Era Darius Hystaspes completed a canal from the Nile, a little above Bubastes, to the Red sea near Patomos: this canal, which was in some places 150 feet wide and 30 deep, passed through the valley of the bitter lakes and was navigable for vessels of considerable burden, while the Nile, which supplied it, was high; the waters serving to irrigate the vicinity of several important cities. There can be little doubt, that originally, the bitter lakes formed the head of the Red Sea; and the Ruins of Serapium and other extensive towns around clearly indicate that the district, at a remote period, was possessed

of great fertility, having been irrigated by the Canal of Sesostris; and at the date of the Exodus it was a fertile and beautiful region,—really "the land of promise." Mr. Stephenson has ascertained that the Sea shells in this district as well as those on both of the raised beaches in that neighbourhood, are the same as those now prevailing in the gulf of Suez: so that at a period comparatively recent all the tertiary beds forming the bottom of the sea, and the contiguous land, must have been elevated from 12 to 18 feet, within less than three thousand years of the present time,—the proof of descent previously to this has been already given in the text.

NOTE B.

BUILDING STONE, p. 179.

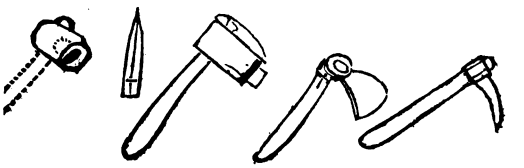
Our principal quarries of these are at Versova, about twenty miles to the north where the shore is sheltered by a vast dyke of basalt formerly submerged.



QUARRY AT VERSOVA.

The sand, which seldom extends more than a few inches down, is first removed and the rock smoothed on the surface. A space about twelve feet each way is next divided into slabs one foot square,—the grooves between them being cut with a light flat-pointed single-bladed pick. These are raised successively by a tool something between an adze and a mattock, a single stroke of which is in general sufficient for the detachment of each from its bed. The blocks thus cut out and raised being thrown aside, the bed is once more smoothed, and the operation resumed till the pit reaches the depth of six or eight feet; when it being no longer convenient to remove the stones by hand or basket, a new pit is cut. This

variety of building material is brought in vast quantities to Bombay where a large portion of the native houses are built of it. It is not very strong, but with the admirable cement, employed with such lavish hand, it makes a good and economical wall. We must not conclude this without noticing the native sledge-



Hammer.—Punch.—Sootkee.—Stone adze.—Versova pick.

hammer employed in breaking trap, granite, limestone, and the other numberless varieties of rock,—and one of the most efficient tools that can be made use of. Its handle is generally of male bamboo about two feet long; its head is something like that of an ill-shapen axe—thick all along. It weighs about eighteen pounds. In the face or striking portion is a bluntish wedge of steel, fastened in with a piece of leather. With this the native quarryman will break up the most obdurate trap into slabs or blocks of almost any size or form, from a pavement flag three inches thick and two feet square, to a block two feet cube. He looks narrowly at the grain of the stone, and then with a series of blows, of no great force apparently, literally cleaves the stone, which falls in pieces apparently without effort. Similar varieties of this, of exactly the same pattern, are used as hand-hammers—they are called Sootkees. The blasting, or rather the boring tool or jumper, is a plain round rod of iron, about three feet long, pointed at both ends with steel. No hammer is ever employed in boring: the jumper is raised and struck in with both hands, and a man will penetrate an inch or two in an hour. Stones are usually paid for to the quarry owners at so much for each jumper at work. The native punch is a short, dumpy, lancet-pointed tool—it is sharpened by being turned point up, and struck with a piece of flint. When used in stone-dressing, it is held in the left hand, and struck with a hollow-faced iron hammer, the cavity being about an inch in depth and as much in diameter. We have but little to boast of at Bombay in architecture in any way: in the Deccan the most massy structures are raised, and carved from trap, with a delicacy and correctness quite astonishing. The vaults and domes of tombs and temples are commonly bolted with iron from top to bottom, and in many cases, instead of scaffolding, the structure is surrounded with a rough wall ten or twenty feet off, the interval between being filled up with earth: a long inclined plane serves for raising the stones. A magnificent structure of this sort, the tomb of one of the Gwalior princes, has stood half finished near Poona for some thirty years; and here native architecture may be seen in perfection, in all stages of advancement. Our only building materials at the presidency, beside that already described, consist of greenstone, trap, and a fine-grained variety of numu-

lite like Bath oolite,—called, from the name of the place whence it comes, Porebunder stone.

SALT.—One of the most extensive manufactures on our shores is that of Sea Salt; and, simple as the process seems, it is far from devoid of ingenuity or interest. Amongst the numerous islands which fringe the Malabar Coast, there are countless narrows, creeks and inlets, left dry at low tide; the expanse of mud then exposed being often enormous. Off the shores of Sewree the tide at springs retires nearly two miles: and this is nothing at all out of the way in the neighbourhood. When salt-pans are proposed to be established, the first thing is to construct a mud embankment,—a foundation for it being selected where the water is never more than four or five feet deep. The crest of the embankment is made to surmount this by two or three feet—the base of it is generally from two to three times its height. Openings are purposely left at intervals in the principal embankment, and from these, at right angles to the main of the wall, other embankments are run inland, parallel to each other, leaving a current between large enough to admit of a line of salt bouts running up. Immediately behind the embankments the salt-pans are laid down. These consist of rectangular compartments, from twenty to thirty feet across, and commonly twice as long as they are broad, and from a foot to a foot and-a-half in depth. They are separated from each other by little mud walls about three feet across at bottom, and two at top, more or less, according as little channels for filling the pans are meant to be run along them or not. Two, three, or four, lines of pans, according to the extent of the back water, are carried along the rear of each embankment—care being taken to leave an area of land capable of being flooded by the sea betwixt the pans and the mainland, three or four times the size of the pans themselves. So soon as the monsoon is fairly over, all the fresh water that has accumulated in the pans or back water is run off, and in November or December the sea is admitted to the back water through a sluice in the embankment. The pans are now carefully cleaned out, their floors and walls being made smooth and nice. In about a month after it has been admitted to the back water, the sea-water, now getting reduced in quantity, and increased in saltness by evaporation, is let into the pans. The first charge requires about six weeks to evaporate: subsequent charges are dried up in half the time of the first, thus diminishing as the season becomes hotter, and the brine more strong. The strength of the brine is judged of by its becoming red: in fact, a curious variety of creature, of the volvax kind, which seems never happy unless in a pickle —the same as is to be found in a fossil state in the Punjaub rock-salt, and which often tinges the waters of our sea shores as if stained with blood,—makes its appearance just as the salt is ready to crystallise,—often tinting the salt itself of a fine pinkish hue. When very nearly dry the salt, which has now accumulated to the thickness of an inch or two, is raked off; the upper portion, which is beautifully white, and almost quite pure, being first taken,—the lower portion, often crystallised in pieces of half an inch cube, is taken up next,—it is slightly mixed with clay, and is that generally in use. The white and bluish salt are now piled

up separately in conical heaps, about sixteen feet in diameter and ten feet high, which are preserved with a thick thatching of grass during the monsoon. The white salt is as pure as any in the world—the black salt is mixed with about one or two per cent of clay. Both are, in a great measure, free of the magnesian salts and sulphate which contaminate pan-made salts at home;—everything more soluble than muriate of soda, remaining behind in solution, is washed away by the rains. Salt-pans are much less efficient when new than afterwards, and they continue to improve as the ground becomes impregnated for ten or fifteen years. When the first crystallisation is unsatisfactory, as it often is, a second charge of brine is let on before the salt from the first is removed. The evaporation in the back water goes on, of course, as rapidly as in the pans themselves, and by this contrivance, which requires no care or preparation, an amount of evaporating surface three or four times that of the pans is secured: the pans, themselves, only require trouble or attention, the backwater requires none. The pans are drawn from three to four times every year: as the rains approach they are abandoned for the season. The sea is seldom let in more than once or twice into the back water: were the whole available surface kept covered, double the amount of salt, at present manufactured, might be made. The supply, however, is so close on the heels of the demand, and the profits are so very low, that there is no reason why production should be extended. Such is the convenience of our shores for the manufacture, and so easily and so cheaply can the process of storing and carrying away be managed, that all the attempts made by Banians to bring salt from Scinde, where it is to be had in unlimited quantity ready made, have proved unremunerative. The idea, therefore, of importing salt from England, into India, is about as chimerical as any that ever entered the human imagination, while the abuse heaped on the quality of the salt used in India is as undeserved as may be. The upper salt is scarcely surpassed in purity by the finest the Chesshire mines send forth: while the black salt contains as much of the pure muriate of soda as does the common pan-made salt at home. The matter which contaminates the former is conspicuous, and looks very dirty, but then it is perfectly harmless: the subtle contaminants of the latter are eminently mischievous, though invisible. An English adult is supposed to consume at an average of from fifteen to twenty pounds of salt annually, so that he will, in this way, swallow some three ounces of mud a year: it will be a long time before the peck of dirt every one is said to have destined for him in the course of his lifetime, be at this rate consumed: in India, numbers of people eat pounds' weight of clay by choice!

NOTE C.

FORMATION OF KUNKUR,—OR THE NEW FRESH WATER LIMESTONE OF INDIA. p. 179.

KUNKUR.*—Is a variety of freshwater limestone, found in great abundance all over India, forming the principal material from which quicklime and mortar for

* So called from the Hindustain word of Sanskrit extraction, signifying a nodule of limestone, or pebble of any other rock.—Newbold. Jl. London Assiatic Society, vol. xiii. p. 258.

vements for building purposes is obtained. It is occasionally found in extensive beds in the form of solid and continuous rock, and in this shape it is excavated for pavements in slabs and blocks from the bed of the Jumna,* in the form of what Captain Abbott calls confluent Kunkur.† It appears in extensive fields from one to five feet in thickness, generally very rugged and porous; it is occasionally separated into compact masses of a hundred solid feet or more. In this shape it is found below Allahabad in the alluvium of the Ganges. Near Benares it appears as a shell limestone—that is quantities of recent fresh-water shells are cemented together by kunkiferous matter into a sort of rock. This varies from one to two inches in thickness, and covers an area from fifteen to twenty miles in extent each way: it is from twelve to twenty feet under the surface, and is supposed to mark the basin of a former lake,‡ and under similar circumstances and position, though on a smaller scale, and apparently due to a like origin, it is met with near Poona, in the Deccan. "The older Kunkur," says Newbold, (Journal London Assiatic Society) "is usually of a light brownish, dirty cream, reddish, or cancerous grey tint; sometimes compact and massive in structure, but more frequently either of a nodular, tufaceous, pisiform, botryoidal, or cauliflower-like form—Its interior is sometimes cancellar, or slightly vesicular; but compact or concentric in the pisiform and nodular varieties. Its interior structure is rarely radiated. When compact it resembles the older travertines of Rome and Auvergne. It aggregates in horizontal overlying masses, usually intermingled with the soil without much appearance of stratification. It is broken up, and used as a rough building stone in the bunds of tanks, walls of inclosures, &c., by the natives, and is universally employed to burn into lime.

A specimen of kunkur, analysed by the late Mr. J. Prinsep, yielded, Water of absorption, 1 4, Carbonate of lime, 72 0, Carbonate of magnesia, 0 4, Silex 15 2 Alumina and oxide of iron, 11 0, ——— 100.0

Some varieties contain so much silex as to give fire with steel: others are almost entirely composed of earthy white carbonate of lime and crumble between the fingers." I have already described in the text the aspect generally assumed by the Kunkur of the marine blue clay, which so strikingly resembles the nodules of chalk-flint in its form and exterior aspect—to this the reader is referred. The Kunkur at Ghazeepore says Capt. Baird Smith from whom the following is taken is described by the Rev. Mr. Everest as "resembling much in the shapes it affects, the flints of the chalk strata. The bank of the river (the Ganges) shews a section of a layer about four feet thick, formed of these pieces. This layer is gradually lost in the clay above and below. In some places the layer or seam is double, with an intervening bed of clay, through which the lower kunkur bed is said to branch off and join the higher. The beds are

* Prinsep. Bl. As. Trans. 1833, vol. ii. p. 625.
† Capt. Abbott Bl. As. Trans. 1845, vol. xv. p. 442.
‡ Captain Sherewell.—Bl. As. Trans. 1846, vol. xx. p. 14.

farther similar to those of chalk flint in the manner in which the loose pieces are imbedded in the clay, and in the layers being composed of detached pieces. Now it appears some presumption against the whole of these vast collections of nodules being due to calcareous springs, that recent though their formation has been proved to be, there are no independent indications of the existence of the springs whence they could have been derived. So universal is the prevalence of kunkur, that it is scarcely possible to believe the whole traces of its originating sources have been obliterated. Farther, from the appearances of the beds with which the kunkar is associated, it is evident that no springs have been in action since they were deposited, and the nodules must consequently have been brought from a distance. There is some difficulty however in accounting for the occurrence of beds 4 feet thick, with no intermixture of foreign substances, but consisting entirely of nodular limestone, on this supposition. Detritus of such an origin is invariably mixed, and contains specimens of the different material which the force of the transporting agent was capable of bearing along. The shooting of branches and the gradual passing of the kunkur into the clay above and below, seem farther to militate against the idea of the operation of powerful, or even any transporting agency. It has been said that the kunkur of India has no analogous formation in the world; but I conceive this to be doubtful, as it is known that the London clay* contains numerous contemporaneous nodules of hard marel or clayey limestone, which occur in regular horizontal layers at unequal distances, usually varying from four to forty feet apart. These nodules are called Septaria, from their being divided by partitions or veins of calcareous spar, and in their cavities are frequently found crystals of calcareous spar (carbonate of lime) and heavy spar (sulphate of baryta.) The Septaria are surrounded by crusts which contain a smaller proportion of lime than the central parts; and of the Ghazipoor kunkur, Mr. Everest remarks similarly that its cavities are lined with crystals, and that while the fresh fracture is of a brownish grey colur, exhibiting the stone compact, the exterior is covered with a white or yellowish white crust. The chemical composition of the Septaria of the London clay is identical with that of the Ghazipoor kunkur, consisting chiefly of carbonate of lime with silica, alumina and oxide of iron, or slightly ferruginous clay, and the natural cement stones of Harwich, Sheppy, and other places, are used for the same purposes in England as the kunkurs are in India.† In the tertiary basin of Paris similar tuberose masses are found in the clayey and calcareous marl of the fifth and sixth formations.‡ It is scarcely necessary to remark, that I do not mean to contend that the Indian kunkurs are contemporaneous with the similar concretions of the tertiary formations of England and France, I only wish to exhibit the analogy existing between them, as this may help us to some explanation of their origin. The analogy might be extended to several other members of tertiary formations, as the strata

* Cuvier's Theory of the Earth.
† Fasley on Cements, and Note, C.
‡ Cuvier's Theory of the Earth.

of the Isle of Wight, in which Mr. Webster* informs us both the nodular and the flat form of concretionary limestone are met with; but I would now proceed to offer a few remarks on the probable origin of these substances.

"The forms effected by the nodules of kunkur, and the circumstances of their dispositions in the clayey beds with which they are associated, have frequently been recorded by observers as being strikingly similar to those of the flints in the chalk strata, and it was these analogies which first led me to suspect that the information we possess concerning the origin of the one might be made to bear upon that of the other. From the state in which the fossils of the chalk strata are found, many of them perfect in their most delicate details, some of the shells preserving even their fine pearly lustre, and the soft scales of fishes being often found beautifully preserved in the structure of flints, we are warranted in concluding that they were quietly entombed near the spots where they lived and died, and that consequently no transporting power of energy sufficient to bear from a distance the associated masses of flint could have been in action upon them. We are thus led to believe the flint contemporaneous, or nearly so, in its origin with the chalk in which it is imbedded, and as the flint occasionally passes imperceptibly into the chalk, the nodules of the one near the line of junction being replaced by those of the other, there is thus afforded an additional argument for the flints having been formed in the places where they are now found, and against their having been derived either from silicious springs, or other sources, and brought from a distance. In like manner the flints which are found in the lower beds of the great gypsum formation of the Paris basin pass gradually and imperceptibly into the gypsum itself; a proof, (says Professor Jameson in allusion to this fact) of the contemporaneous origin of the two substances.† Similarly the peculiarly perfect and beautiful state of preservation in which the fossils of the London clay are found, would lead us to infer the quiet and contemporaneous formation of the horizontal beds of nodular limestone with which they are associated; and in truth this is put beyond a doubt from the circumstance that the Septaria have frequently been found to include fossils similar to those occurring in the body of the clay. From these analogous cases, and the consideration of others, I have thought it unnecessary to detail, I have been led to consider the Indian kunkur beds as being formations 'in situ,' and nearly contemporaneous in their origin with the beds of calcareous clay with which they are associated. This remark applies to the kunkurs of those localities where no proofs of the previous existence or operation of calcareous springs can be detected, and where the facts oppose the idea of transporting forces having been in action."

The preceding is taken entire from an excellent paper on the Deltas of the Ganges, prepared by Captain Smith in the first volumn of the Calcutta Journal of Natural History.

* Geological Trans. vol. ii. p. 209.
† Cuvier's Theory of the Earth. English edition.

The other kunkurs chiefly prevalent on this side of India are mostly spongiform in external aspect—those in the beds of our great Deccan rivers, in the assumed basins of former lakes, often so closely resemble the roots or twigs of trees, or branches of coral, as to be mistaken for petrifactions—in this case a rootlet of grass, or vegetable fibres, will generally be found forming the nucleus on which the calcareous matter has been deposited. Captain Campbell speaks of a red arenaceous loam prevailing in the table-lands of Southern India, which is penetrated by Ramose kunkur in all directions, both vertically and horizontally, the pieces being continuous from the surface to the depth of eight or ten feet. A remarkable formation of this kind is found in a valley ten miles in length, and four in breadth in Burramahal.* The kunkur which abounds in the cotton soils of Salem, in the same quarter, is sometimes so completely cellular as to resemble a honeycomb—the quantity is greatest at the bottom of the bed of soil.† The black cotton soil abounds with the smallest nodules, from the size of a pea to that of a filbert: in the N. W. Provinces these form in continuous sheets a few feet under the surface, constituting a serious annoyance to the agriculturist and gardener—after the ground has been completely cleared of them it yields them as abundantly as ever in a few years' time. I have met in with some singular varieties of kunkur at Gogo, on the coast of Kattiwar, the result obviously of the deposit of lime in the cracks of the clay, of which a very beautiful cast is presented. These are procurable from the size of a walnut to that of the human head—the clay found in them, and adhering to them when found, is easily washed out of them,—the spongy calcareous mass remaining being almost pure white. The marvel in this case is how the cracks in the clay should retain their form while water was penetrating through them. Kunkur is found in almost all parts of India, with the exception, it is said, of the summits of the Neilgherries;‡ it is to be met with at altitudes of 4000 feet and seems as plentiful all over the Punjaub as in any part of Hindoostan. It is not supposed to be met with in Affghanistan, Persia, Scinde, or any quarter beyond the influence of the periodical rains. The formation of kunkur was wont to be ascribed to the action of calcareous springs now extinct or nearly so, and to this theory for the older varieties of the rock Captain Newbold seems to the close to have felt disposed to cling: the view is opposed by Capt. Campbell, Capt. Baird Smith, Capt. Abbott, and others, and I think with justice. The formation of certain varieties of kunkur is proceeding daily before our eyes, and it seems to me to be much more reasonable to ascribe the whole of the kunkurs—so closely resembling each other in their general characteristics, and the most dissimilar varieties merging into each other by such undis-

* Captain Campbell on the formations of the table-lands in Southern India. Calcutta Journal of Natural History, vol. ii. p. 309.

† Ibid, p. 310.

‡ Newbold *ut sup.*

tinguishable gradations,—to one great origin actually before us, and of simple explanation, than to seek for other agencies now no longer in operation, and of whose existence at any time we have no positive proof. It has been already stated that the rapid formation of kunkur under the surface of the ground is in some of the districts near Agra a source of serious annoyance to the cultivator. All the shells and organic remains found in kunkur are recent, and masses of it are found to penetrate and surround the mangrove roots in the marine blue clay, the wood of which is still fresh and sound. The theory of the formation of a mineral of such extensive prevalence, and the very name of which is, strange to say, omitted in our Home geological indices, seems to be this:—The soil of India everywhere abounds with lime or fresh water and land shells in a state of extreme comminution: this is freely taken up by the rain during the earlier part of the monsoon, the solution being probably assisted by the heat, and the enormous quantity of carbonaceous matter, the rank growth and rapid decay of vegetables during the rains originate. When the rains cease, and the heat which follows dries up everything, of course the lime previously in solution is precipitated, and seeks a nucleus wherever it can find one. So rapidly does rain-water act on lime in India that a marble slab exposed to it will in a few days' time lose all its lustre, and in the course of the monsoon become corroded, as if acted on by an acid. Fine branches of coral exposed to it lose in a few days' time the translucency which adds so greatly to their beauty, and become dull and opaque as if white-washed: both these I have made subjects of frequent experiment.

The solvent power of pure water acting on limestone, considerable in itself, is enormously increased by the presence of carbonic acid. The cementation of the shells constituting the rocks I have termed littoral concrete, it is obviously effected by water charged with lime, and is now in progress. I have already adverted to the singular circumstance of this process proceeding with great vigour and activity at one place, while at another close by, similarly situated in all respects, it should be in entire and absolute abeyance.—See Proceedings of the Society for April 1851, p. xlviii.

NOTE D, p. 189.

SELENITE OR GYPSUM.—In the small crevices and fissures pervading shales or aluminous schists, where these are exposed to the air, numberless little crystals, of selenite are generally found to prevail. I remember, when a very young chemist, indeed, to have made a large collection of these from a coal seam which crops out near the Witchlake, St. Andrews, and to have been greatly perplexed to account for their appearance. The shale specimens from the Indus, recently presented to the Bombay Geographical Society, by the late Capt. Christopher, are pervaded in all directions by beautiful veins of Selenite. In both these cases the production of the mineral is easily explained: coal shales almost always abound

in sulphurets of iron; and these, in process of decomposition, act on the lime pervading the clay, and so form sulphates of lime.

By some such process as this, in all likelihood, is the gypsum,—found at Aden and in the other Arabian volcanoes formed; it is sometimes fibrous, and always pure and singularly beautiful. As gypsum is decomposed at a temperature a little above 400 Fahrenheit, the mineral must have come into existence after the lavas had become comparatively cool.

In the Great Egyptian desert, betwixt Suez and Cairo—in the deserts of the Peninsula of Mount Sinai, Dr. Wilson states that on the table-land of Tibbal Tih, about 5,500 feet above the level of the sea, he found marine sand and gravel. Here he found sulphate of lime, exactly as it occurs near Suez (Lands of the Bible, vol. 1. p. 264 edit. 1847.)—Dr. Hoffmeister describes a sort of terrace 1500 to 2000 feet high, on the mountains near Suez, covered with gravel and travelled stone; on which fragments of selenite and gypsum were to be seen in abundance.

He describes a long white vein of Anhydrate as here running across the Rocks. (Travels in Ceylon and Central India, p. 90 edit. 1848—).

All along towards Palestine, and by the shores of Arabia and the Persian Gulf, and so down to Scinde; then again upwards to the confluence of the Five Rivers forming the Indus, veins of selenite, in every direction, traverse the salt shell gravels and sand which cover the rock, and which as already stated, belong to the newer Pliocine formation. The shells, indeed, are often as fresh as those to be found within high-water mark, and when the surface of the ground is covered with a heavy dew it would require no effort of imagination to suppose that the sea had just retired, and might return again next tide—the mirage exhibiting the likeness of expanses of water near at hand, heightening the delusion.—Nothing can contrast more strikingly with the gravel and rolled pebbles everywhere prevailing than the fine fibrous or tale-like veins of selenite which make their appearance in all directions. They sometimes branch off from a common centre as if filling up a group of cracks; sometimes they are to be seen stretching for miles almost in a straight line across the country.—Sometimes they are partly covered over with sand—occasionally the wind blows the drift around them, the veins arising in lines some inches above the surface. In this case the plates are frequently seen to have fallen over, and to lie scattered about in pieces over the desert, retaining on all occasions the sharp edges and bright polished surfaces which contrast so strikingly with the material around.—I have never found them to extend more than a few inches, 10 or 12 at most, under the ground; and have, on all occasions been able, with a little scraping, to eradicate the vein. In the vicinage of the veins salt is always particularly abundant; consisting, generally, of a mixture of muriate and carbonate of soda. When the hot dry Kamsin wind blows, the surface feels crisp and hollow, and yields under the feet like wet ground which has been much tunnelled by moles and is partially frozen. On ordinary occasions it feels damp and clammy, the finer particles of

the sand adhering to the feet.* Sea salt generally contains from 3 to 4 per cent of sulphate of soda, magnesia, and lime; and it seems to me more than probable that the two former of these acting on the carbonate of lime, the coraline limestone and shells, which here everywhere constitute the chief elements of gravel, produce selenite and sodalite. The sulphate of lime† originally existing is probably added to that being brought into existence. The Idea of Berthollet, that the Trona in the lakes of Ferrar has been produced by the action of muriate of soda and carbonate of lime, in their pasty state on each other, has now been generally accepted. Dr. Malcomson's reports, too, explain the deposition of soda in the Loonar lake, and a short extension of the theory seems to me alone capable of explaining the formation of selenite such as that described. Gypsum, indeed, is usually associated with the great salt formations, and probably everywhere claims a similar origin; it occasionally presents itself in the desert, not as a selenite but as the cementing matter of a strange species of conglomerate, now in process of formation. This consists of gravel of the desert with fragments of the earlier remains of the numulite formation,—of bones of camels, horses and birds of prey, and fragments of soda water bottles—all the materials, in short, that are strewn around united together in one promiscuous mass—At Bombay we have it acting conjointly with carbonate of lime, as the cementing matter of a great bed of concrete in process of formation under our raised sea beaches, and about 10 feet beneath the surface, and close on the medium level of the sea.—All over the vast plain which constitutes the Deccan or great table-lands of India—patches of sea salt, associated with carbonate of soda, occur. Many of the wells at Ahmudnuggar are brackish (says Col. Sykes, p. 425, Geol. Trans.) and a rivulet near by, running into the Beema, has it source two miles to the N. N. W. which is called the Salt Brook. The stones in its channel are crusted over with crystals of salt and carbonate of lime. The river Doon near Bejapore is perfectly salt at all times. Salt is found between Kirjut and Pairgoon, between Seeroor and Kouta, and at Kabar Loonee, 12 miles from Poonah,—In all these cases carbonate as well as muriate of soda is described as found—the former is eagerly sought after by the washerman. Dr. Gibson mentions that with these gypsum is always associated, and I have no doubt that everywhere the three will be found together.

Captain Dagerfield mentions the occurrence of gypsum in Malwa as associated with sea salt; he does not state in what form it occurs, and as I am not aware of the existence of the salifirous formation in Central India, I presume it to be under the circumstances similar to those in which it appears in the Deccan.

* In April 1840, when a hot Kamsin wind was blowing, I found the former state of matters to prevail; in December 1845, with a fresh breeze from the sea, the latter.

† Rock Salt seldom contains more than 1 and one-tenth per cent of sulphate; sea salt contains from three to four per cent. May not this be adduced as a confirmation of my theory? The Sulphate of the Rock Salt has become decomposed and disappeared.

Having been much occupied in plaister-casting, in the early part of 1848, many pieces of broken plaister were lying about as the rains approached. To my surprise I found, that as these began to be washed away, they became covered with crystals, many of which extended some way into the surface and protruded as much as a quarter of an inch beyond it. They could not, in any case, have been the result of deposition from solution, as they made their appearance quite as often on convex surfaces as in cavities, the rain fell with such violence as to prevent any great accumulation of water; and the moisture which might have temporarily accumulated in irregularities, during the fall, passed away the moment it faired. In observing this I collected a multitude of fragments and placed them in an iron pan with water, the stucco on all occasions rising above its surface. I was disappointed to find that no further effects resulted from this than those found to prevail after the rain had for a week begun. The outer surfaces of all the castings that had been exposed were considerably hardened and covered with crystals all over. Some of these castings I had afterwards occasion to pack up, and on those which had been carefully wrapped in paper and kept dry, I found portions beginning to harden, or which were, completely hardened into fine semi-transparent crystalline gypsum, which occupied exactly the same space as before crystallization,-there being no crack or trace whatever of shrinkage around it. In the course of casting I had repeatedly overburnt the gypsum; it was indeed so much more easily ground when heated to redness than when merely raised to a temperature of 350° that the Natives at first overburnt it to save trouble. Though it ground and sifted beautifully, it either set partially or altogether refused to harden; remaining wet and clammy, and afterwards breaking to pieces and mouldering in the hand. In this case the sulphuric acid had either been driven off or partially decomposed. The stucco when mixed with water gave out numberless bubbles of sulphureted hydrogen gas, exhibiting the usual fœtid smell of gun washings. Even when decomposition had been only partial, the amount of over-heating being very inconsiderable—the extrication of gas bubbles, in the process of setting, was often very troublesome; altogether detroying the surface of the cast. I found a partial remedy for this in working the mixture of pounded stucco and water betwixt the hands as along as possible; that is for a minute or so, till it began to thicken; the gas bubbles were thus broken before the stucco was applied after which it began to set immediately. When the stucco was damp or underburnt I placed it in an iron pot and exposed it to a heat of 300° when numberless vapour bubbles disengaged themselves, and its setting property was developed to the fullest extent. In the experiment above referred to I watched with the utmost care the effects of rain on the over and underburnt specimens, but could observe nothing remarkable in either case. The former, as soon as they became soaked with water, fell to pieces; they had before merely cohered mechanically. Some twenty or thirty years ago, a ship load of gypsum appears to have been brought to Bombay, from the Persian Gulf. As no use could be made

of it, it was left exposed to the open air and it was curious to observe that by the effects of the monsoon all the pieces had assumed the same form thus:—

(All of them were grooved.) Major Smith, in his translation of the work of Vicat on cements, states on the authority of the late Dr. Malcolmson, that gypsum is to be found in crystals in the cement of the Great Pyramid. In a correspondence I had with him on the subject, we both came to the conclusion that this could have formed no part of the original mortar; because the heat requisite for decarbonizing limestone decomposes gypsum. Gypsum does not bind with any considerable force, and is neither hard nor strong. It is moreover liable to become dissolved by moisture, and so wasted away. The Gypsum in the cement of the Pyramids must then, in all likelihood, have come into existence after the Pyramids had been built, and this most probably by the same process as that which brought the gypsum of the Desert itself into being—the action of the sulphates previously in the mortar in the contact with lime.*

It may here be mentioned, as a curious fact, that though gypsum abounds in the Punjaub, in Scinde, Arabia, Egypt, and the coasts of China, and probably in most parts of Hindustan, it is no where, so far as I have been able to discover, employed for the purpose of casting, save in Scinde. In Bombay it is burnt at a strong red heat, and it is then used in place of quick-lime in chewing with betel-nut. In the Deccan it is moderately burnt, then ground and used as white-wash. It is peculiarly well adapted for this in white-washing the Poonah figures which are made of unburnt clay, and fall to pieces when exposed to moisture. The stucco sets on them in a few minutes and it seems singular that a people so ingenious as the Mahrattas should have overlooked its aptitudes for casting, which must often have been developed before them, by plaister hardening accidentally in the vessels in which it was mixed with water.

I was first made aware of its being employed in Scinde by Lieutenant Burke, Bombay Engineers, who was kind enough to give me specimens of the work, so as to set at rest any doubt that might have been entertained on the matter. It is chiefly employed in casting latticee and open work for the tops of doors and windows, and for other purposes when the partial admission of air is desirable. The extreme dryness of the climate of Scinde saves it the risk of injury from exposure. I am not aware in what part of Arabia or Mesopotamia gypsum exists, chiefly as a rock; but the whole of the sculptured slabs brought from

* Translation of Vicat on Cements, page 115, 116, and Appendix lxxii. The appearance presented by the selenite in the mortar of the Pyramids, as described by Major Smith, corresponding exactly with that presented by the crystals on the broken stucco. Major Smith at first supposed that they were due to the circumstance of the mortar having been originally composed of ground selenite used in place of sand, as the mortar contains no siliceous matter. He afterwards seems disposed to account for it from the abundance of saline matter in the water around.

Nimrood and its neighbourhood are composed of it. It is generally brown or greyish, often mottled; and in some cases pure white. It almost always exhibits signs of stratification, and on the sides of many of the slabs the arrangement of the layers over each other is very beautiful. It seems as if it had risen readily from the quarry bed in slabs. The gypsum brought, as already mentioned, from the Persian Gulf to Bombay, about the year 1820, corresponds exactly in all these particulars with that out of which the slabs are wrought, and is identical with some of the finer Italian alabasters. When in charge of the Observatory in 1843, I found a quantity of pieces of Persian Gulf gypsum lying about the compound. I immediately set about converting it into stucco — but fell into the usual error of overburning. In 1845, when in England, I obtained some instructions from a plaister-caster, and found the safest mode of burning to be to send the gypsum to a baker's oven. In 1847, Mr Wilson, of the "Bombay Times Office," commenced plaister-casting. He provided himself with moulds from England, and was the first who succeeded in casting, on a considerable scale, in Bombay. In 1847 I had it extensively carried on at Sewree. It is impossible by reason of the dampness of air at Bombay between May and October—the stucco absorbs moisture while in powder, it sets slowly and is almost sure to crack in drying; or if it escapes this it warps and twists when set aside. It produces always very soft castings; it is exceedingly beautiful to see the beneficent arrangements of Nature thus in process of elaboration under our eyes. The earth, long submerged under the water of the ocean, becomes necessarily impregnated with sea-salt, and is thus incapable, for a time, of supporting land plants. The rain and dew, by the mere process of ablution, washes this away from its surface only. But then comes the principle of capillarity into operation, and the damp charged with saline matter is drawn up from the utmost depths—the moisture being exhaled into the atmosphere while the salt remains as a crust on the surface—to be washed away by the first rain that falls, and then transported either into the sea and restored to the grand magazine from which it was originally taken—or deposited in beds and masses for the use of living creatures, far removed from the sea coast, and which but for the salt beds in the interior would be deprived of a most essential article of animal existence.

Simultaneously with these processes we have the muriate of soda, acting on the carbonate of lime, in the pasty state which breaks through the usual law of affinity; giving us a carbonate of soda,—a mineral of the utmost value to man; and muriate of lime—a salt of no economic value; and so soluble that the slightest moisture keeps it in the state of solution till it is washed away.

The soluble sulphates again act under similar circumstances on the carbonates around, adding to the Trona generated by the muriates and carbonates, and a new mineral selenite or gypsum of great beauty and utility, and which results from the destruction of salts inimical to life and vegetation (the sulphates of soda and magnesia) comes into existence. It seems not impossible that to

a new mineral selenite or gypsum of great beauty and utility, and which results from the destruction of salts inimical to life and vegetation (the sulphates of soda, and magnesia) comes into existence. It seems not impossible that to the decompositions the extreme bitterness of most of the wells of the desert is due. They taste much more of the muriate of magnesia and the bittern of the salt-makers, than of a solution of muriate of soda.

NOTE D, p. 194.

LATERITE.

I have had repeated occasion to allude in the text to the rock called laterite, and as no description of this most mysterious formation has ever been published in any of our Bombay Journals, though the rock itself abounds in the Presidency, I take the following account of it by Captain Newbold, from the Journal of the Royal Asiatic Society, of London.

I must at the same time state my entire dissatisfaction—with all the theories of its formation hitherto offered—the whole seems buried in impenetrable mystery.

"This rock derives its name Lateritis, (bestowed on it by Francis Buchanan,) from its being cut into the form of bricks, and used as such by the natives, who term it often in their own dialects the brick-stone. Buchanan* identifies it with the Argilla lapedia of Wallerius.

"The laterite varies much in structure and composition; but, generally speaking, it presents a reddish brown, or brick coloured, tubular, and cellular clay, more or less indurated, passing on the one hand into a hard, compact, jaspideous rock, and on the other into loosely aggregated grits or sandstones, as at Beypoor near Calicut, Pondicherry, &c., and into red sectile clays, red and yellow ochre and white porcelain earth, plum-blue, red, purplish, and variegated lithomarges. Sometimes it presents the character of a conglomerate containing fragments of quartz, the plutonic, hypogene, and sandstone rocks, and nodules of iron ore derived from them, all imbedded in a ferruginous clay.

"The cavities are both vesicular, tubular, and sinuous; sometimes empty, but in the lower portions of the rock, usually filled, or partially filled with the earths and clays above-mentioned, or a siliceous and argillaceous dust often stained by oxide of iron. A species of black bole, carbonized wood, and carbonate of lime, sometimes occur, but rarely, in these cavities. Minute drusy crystals of quartz not uncommonly line the interior.

"The walls separating the cavities are composed of an argillosiliceous paste, often strongly impregnated with iron, and frequently imbedding gritty particles of quartz. The oxide of iron prevails, sometimes to such an extent as to approximate a true ore of iron, and the nodules are often separated and smelted by the natives in preference to using the magnetic iron ore, which is more difficult to reduce, from its greater purity. When the whole mass is charged with iron, and very vesicular, (not unfrequently the case,) it might easily be mistaken for iron slag. The colour of the parietes separating the tubes and cells, which in the less ferruginous

* Journey through Mysore, Canara, and Malabar, Vol. II., pp. 436 and 440.

varieties is a light brick red or purple, changes into a liver brown; having externally a vitrified or glazed aspect; while the surface of the interior cavities puts on iridescent hues. The walls of these cells are sometimes distinctly laminated.

"The specific gravity varies, as may be supposed from what has just been said. Many average specimens of the laterite of the Malabar coast I found to range between 2·0 and 3·2; that of the laterite of the Malay peninsula was found by Dr. Ward to be 2·536.

"Before the blow-pipe the walls of the cavities melted into a black shining glass powerfully attracted by the magnet. The brown paste and ochreous dust contained in the cells did not fuse, but were converted into a cineritious slag less powerfully attracted, whilst the reddish and purplish portions hardened and remained almost unchanged beyond exhibiting scattered minute magnetic globules, having a dark metallic lustre.

"The air exposed surfaces of laterite, as previously remarked, are usually hard, and have a glazed aspect, and the cavities are more empty than those in the lower portion. A few inches or more below the surface the rock becomes softer, and eventually, as it descends, so sectile as to be easily cut by the native spades, but hardens after exposure to the atmosphere. Hence it is used largely as a building stone in the districts where it prevails, and to repair roads. From its little liability to splinter and weather, (time appears to harden it,) it is a good material in fortifications; for which, and in the construction of their early churches, it has been largely used by the Portuguese on the western coast, and in their settlements to the eastward. The Arcaded Inquisition at Goa was built of it, and the old fortress of Malacca. The angles of the blocks of laterite in the remaining portions of these massive structures are as sharp and perfect as though the block had been separated from the rock but yesterday, although upwards of three centuries have elapsed.

"The accumulation of the clays and lithomargic earths in the lower portions of the rock, which absorb some of the moisture percolating from above, renders the mass soft and sectile. These earths, doubtless, existed once in the upper cavities of the rock, from which they have been gradually removed to the lower strata by the downward action of the water of the monsoon rains. They accumulate at various depths from the surface and form impervious beds, on the depressions of which the water collects, forming the reservoirs of the springs we often see oozing, as at Beder, and many localities on the Malabar coast, from the bases and sides of lateritic hills and cliffs. Some of the tubes and cavities are 'culs de sac,' and do not part with their contents, but the generality have communication with those below them, either directly or indirectly. The downward action of the water, by working through the thinner parietes, has tended to improve this communication: for we find in the laterite cliffs of Beder, where a horizontal layer of impervious matter occurs in the substance of the rock, that the sinuous tubes in the laterite immediately above it, have been diverted from their usual obliquely downward direction, to one nearly horizontal, showing that the water, on arriving at this obstruction to its progress downwards, spread itself laterally horizontally over its surface.

"In the same cliffs empty sinuous tubes, having a generally vertical direction, are observed, varying from a few lines to two inches in diameter, and passing from the surface of the rock to considerable depths in its substance. One was traced thirty feet until it disappeared in a projecting portion of the cliff.

"They occur on a still greater scale, forming caverns of great extent, if we believe one tenth part of the native traditions regarding them. Such is the cave shrine of Sheikh Furreed at Cuddry, about two miles from Mangalore.* This is a hole in the centre of the side of a perpendicular rock composed of laterite, which is said to lead all the way to Hydrabad, 450 miles! The opening is square, about six feet above the ground, ascended by a flight of stone steps, just large enough to allow a person to crawl in. The cavern is very dark, and no one knows the exact size of it. Adjoining is a chasm in the rock, and of inconsiderable size, which at its entrance has been built up with stone, and an opening left for people to creep in by, as in the other; but this is found open within (or exposed to the air) after it is once entered. More than a century ago, a Mahomedan recluse, named Sheikh Furreed, took up his abode in the cave, and at the expiration of twelve years disappeared, and has never been heard of since. The popular tradition is, that he tried to get to Mecca by this subterraneous route!

"There is another cavern of considerable size, in the laterite cliffs cresting the Sondur Hills, on the table land of the Ceded Districts, into which I penetrated a considerable distance; but not being provided with torches was compelled to return. The entrance was of an irregular oval form, not exceeding six feet in height, and bifurcating a few paces from the entrance into two winding galleries, leading obliquely downwards into the bowels of the rock. The floor is broken by rugged step-like descents. The cavern drips with water, and swarms with bats, hosts of which were disturbed by my intrusion. Its floor is formed of lateritic detritus, covered with the filth of bats, into which I dug for several feet in the hope of finding fossil bones, but was disappointed. The natives aver the cavern was the abode of a giant of old, and that it is of incredible extent.

"There is a similar cavern in the laterite hills of Ingleswara, in the Southern Mahratta country, (of the extent of which the natives have the same extravagant traditions,) and said to communicate with another cavern at Negarhal. In the laterite cliffs of Beder, a narrow winding cavern, about sixty yards in length, forms the outlet of the fine spring of the Farabagh. The Brahmans, ever vigilant in turning the phenomena of nature to extending their dominion over the minds of the superstitious Hindú, have seized on both these last caverns, have converted them to places of idol worship, and guard their entrances with Cerberean pertinacity.

"In the lateritic belt running west of Indore, Oojein, Mahidpore, and Baroda, I perceive Captain Dangerfield † has marked down in his map the site of some caves at Doomnar.

* Dr Herklot's Qanoon-i-Islam. Glossary, pp. LXIX and LXX.
† Malcolm's Central India, Vol. II., Geolog. Map.

"The water that percolates through the roof of these caves in the laterite is often charged with iron, which it deposits in stalactitic, or botryoidal incrustations. The same occurs on a much more minute scale in the smaller tubular and vesicular cavities. Curious spheroidal, reniform, and cylindrical bodies, often as large as a cocoa-nut, have been found in the laterite and mistaken for fossil seeds. Their parietes are usually composed of gritty particles of quartz, often stained by iron, cemented by a ferruginous matter: their cavities, often empty, usually contain an ochreous, silicious, and argillaceous dust; as at Stripermatoor, and Pondicherry.

"Associated Minerals.—Nodular, reniform, and pisiform clay iron ores occur pretty generally distributed. I have discovered veins and nests of black manganese in the laterites of Beder, Calliany, Ingliswara, &c., also alum, and muriate of soda, in that of the Ceded Districts near Bellary; large beds and nests of lithomargic earths, and white porcelain earths, are not uncommon. General Cullen informs me he found a layer of lignite in the laterite of the western coast at Kourkully, about fifteen miles south of Quilon, imbedded in a stratum of dark shales and clays. The bed was quite insulated, slightly inclined, and of a lenticular form, five or six feet thick at the most: the upper portion of the cliff, which is about eighty feet high, consists of the indurated dark red laterite, gradually changing as the depth increases from the surface, into bright and various colours: in these lower portions the bed of lignite occurs.

"General Cullen recently writes me that lignite occurs in other localities in the laterite of Travancore, and that graphite in scales seems to be rather common in it; chiefly conspicuous in the laterite about Travandrum and Quilon. It occurs still further south in large and thick scales, and disseminated very generally also in a kind of laterite close to the foot of the mountain, about twenty-five miles east of Travandrum.

"In 1840, I discovered a bed of lignite with resinasphalt, sulphur, alum, (the result of decomposing iron pyrites,) and mineral copal, near Beypoor in the vicinity of Calicut on the Malabar coast, in a bed of loose sandstone, into which the laterite passes, on the right bank of the river, immediately imbedded in layers of black carbonaceous and aluminous shales and clays containing scattered spangles of mica.

"The beds dip conformably at an angle of four degrees towards the north-east. The lignite bed can be traced about half a mile easterly up the river where it dips below the river's level. Its structure is obscurely stratified, crossed by vertical fissures, surfaces of which are frequently covered with a yellowish efflorescence, consisting of sulphur, iron, and alumina; sulphur, and oxide of iron, also occur uncombined. The carbonized branches, leaves, and trunks lay horizontally, in the black shale. Some were fibrous, toughish when struck by the hammer, and heavy, resembling wood recently charred: others were brittle with a resinous fracture of lustre, resembling bitumen. Many fragments were penetrated with water, holding iron and alum in solution; the former of which appeared on their

a glittering reddish-brown coating. The woody structure was, in ufficiently distinct to show that the principal trees imbedded were di- us. Impressions of leaves and stems of plants were abundant between of shale; but I did not observe any of the dicotyledonous seeds which e lignite beds of Travancore. Some were perfectly black; others of ades of brown exhibiting different degrees of carbonization. A portion carbonized leaf burnt slowly with a slight flame into a reddish ash, he edges. This being subjected to the reducing flame melted on its ly into a greenish enamel, and partly into a dark slag affected by the

mbedding black shale decrepitated slightly before whiteness, emitting ike that of burning coal. It finally fused on the edges into a light rey enamel, slightly magnetic. The most resinous portions of the car- od burned with a clear flame and bituminous odour, into a white ash: e in which the elasticity of the woody fibre was less impaired, scarcely any flame at all, burning into a reddish-brown cinder. The odour owever, resembled that of coal more than that of burning charcoal. The d before the blow-pipe, after giving out two or three bubbles of gas, k slag readily attracted by the magnet. The yellowish cauliflower-like ce on the surface of the carbonaceous bed emitted distinct fumes of a being subjected to the oxidizing flame; melting, after considerable trication, into a dark cinnabar-red globule, which, on being subjected to g flame, was converted, with diminution of bulk, into a black magnetic

hange of colour and driving off the carbonaceous matter by heat, tended develope vegetable character, fibre, &c., where none was before appa- ry obscurely so. The specific gravity of the heavier portions is 1·270, xceeding the average specific gravity of coal, which is 1·250. This vegetable matter has evidently been made tranquilly, from the flat position of the layers of leaves and stems.

writing the above, General Cullen informs me that he now sees much rbonaceous deposit in Travancore, and that it is very extensive. It ex- f in beds of black clay and lignite, of from fifty to sixty feet thick, in s 200 feet, along the laterite cliffs at Venkully, for a distance of three act, and along the coast from Quilon to Venkully. Deposits of the same about the same level, at the distance of two or three miles in land. A posit is seen on the sea shore, about thirty miles south of Travandrum. s, or rather their fragments, were both of monocotyledonous and nous wood in a state of perfect carbonization, and abounded with of iron.

1.—Writers on Indian geology are divided in opinion as to the origin With regard to the igneous theory as originated by Voysey, taken

up by Calder, and put forth by Mr. Conybeare, it must be remarked that, hitherto, no decided volcanic product has been discovered in laterite, no crater or other proof of such origin. It is true, it is frequently seen overlying trap rocks; but it also overlies granite, hypogene strata, sandstone, and limestone, and in none is it ever seen as a dyke; nor are there any signs of forcible intrusion or alteration. In one hand specimen that fell under my observation, the laterite appeared to have intruded into and shattered the sandstone; but in every instance where I have had an opportunity of seeing veins, if they may be so termed, of the laterite in other rocks, in situ, they have occurred as deposits from above, into pre-existing chinks of the subjacent rocks, like the conglomerate which fills fissures in the limestone of Petit Tor; and never injected from below, as is the case with volcanic rocks.

"Fragments of trappean, and other rocks, occasionally are imbedded in the laterite; as also in the subjacent sandstone, and in other rocks confessedly of aqueous origin. Cases occur where basalt underlying the trap as at Beder, has the appearance of passing into it: but this, on minute examination, turns out to be confused blending of the debris of both rocks near their junction; from which distinct and unmixed fragments of either sort could be separated, like bits of granite from the breccias that are usually found near the junction of the latter with sandstone. In many localities, however, the line of demarcation between the laterite and overlying trap is clear and decided.

"Some geologists suppose that laterite is nothing more than granitic, hypogene, and trappean rocks weathered in situ. The facts of its imbedding erratic fragments of sandstone, at the Red Hills near Madras, where it rests on granite, and its interstratified beds of lignite and silicified wood, militate strongly against this theory. Besides, nothing is more common in lateritic tracts than to see a hill of granite, trap, or hypogene rock, capped with a thick crust of laterite; while the adjacent hills, composed of an exactly similar rock, and forming a continuation of the same bed, equally exposed to the action of the weather, are quite bare of laterite. I have examined many beds of it resting on trap, and amygdaloid imbedding calcedonies, heliotrope, and jasper, but have not hitherto detected in the upper or middle beds of the former, any fragments of these hard siliceous minerals which are found to resist successfully the attrition of the most rapid streams of India, and have been carried by them across the peninsula to the ocean.

"I have seen laterite, too, resting on limestone, without any traceable lime in its composition: and containing veins of manganese, when resting on a trap in which hitherto the existence of this mineral has not been detected: facts, proving that the overlying laterite was not the upper portions of these rocks weathered in situ.

"I have often observed, particularly in the Western Ghauts, and on the Malabar and Concan coasts, where the rains fall heaviest, those granitic, hypogene, and trappean rocks, which contain most iron, weather into ferruginous

clays, that sometimes lithologically speaking, resemble laterite; and, when that rock is near, have the appearance of passing into it. I have also observed large beds in gneiss and hornblende schist, of an impure oxide of iron, assume a cellular and pisiform aspect; but such must not be mistaken for the true laterite, nor yet the beds of re-aggregated gravel derived from the laterite.

"When we look up from the microscopic view afforded by these slowly weathering blocks of rock and beds of ore, and cast our eyes upon even the present extent of laterite over the surface of India, the thickness of its beds, its flat-topped ranges of hills, and the gaps effected in their continuity, evidently by aqueous causes no longer in action, its occasionally imbedding waterworn pebbles of distant rocks, its often elevated position above the present drainage level of the country, its beds of lignite and silicified wood, we find no more reason for attributing its origin to the weathering of rocks in sitû, or to their detritus transported by causes now in action, than for attributing the formation of the older sandstones to the present disintegration of the granitic and hypogene rocks, of the detritus of which they were doubtless, as well as the laterite, formed originally.

"The supposed non-fossiliferous character of this rock, which has puzzled many geologists, and inclined others to the theory of its ancient or volcanic origin, may in some measure be attributed to its highly ferriferous nature, often approaching that of an oxide of iron. It is a general fact, and, as Lyell observes, one not yet accounted for, that scarcely any fossil remains are preserved in stratified rocks in which the oxide of iron (derived from the disintegration of hornblende or mica) abounds: and when we find fossils in the new or old red sandstones of England, it is in the grey, and usually calcareous beds that they occur. It is well known, too, that some of the more recent tertiary deposits of Europe are entirely divested of fossils.

"As this singular variety of ferruginous clay and sandstone has not been mentioned by geological writers on other countries than those I have alluded to, it may be presumed that laterite either does not exist under this form at all, or in such small patches as not to have attracted remark. The question naturally suggests itself, why this cellular rock should be confined to India, &c. The solution may be in the highly ferriferous nature of the plutonic, trappean, and hypogene rocks, from which the laterite has confessedly been derived, and in the supposition of a segregation and subsequent re-arrangement of the different mineral particles in the substance of the rock itself, by a process in nature's laboratory, approaching to crystallization, better known than explained or understood. If electricity, which is probable, has any share in exciting this movement and attraction in the mineral particles of the rock, its metallic nature affords a favorable condition for the active development of this powerful agent. The structure of the rock has received some modification from the action of water, in emptying its shells and carrying their contents to the lower parts of the beds.

"Age.—Having said thus much to warrant the classification of laterite among rocks of an aqueous and mechanical origin, I shall proceed to remark that in age, relatively to other rocks of Southern India, it is older than the regur and kunkur, which it underlies, and of more recent origin than the overlying trap, the shell limestone of Pondicherry, and the diamond sandstone and limestone, on all of which it is superimposed. It has never been invaded by the dykes of trap that penetrate the latter rocks—the hypogene and plutonic rocks,—fragments of all which it sometimes imbeds, but is evidently contemporaneous with the efforts, or series of efforts, by which the Western Ghauts were lifted above the waters; since it is seen capping their summits, often shattered into large irregular blocks,

and stretching more continuously, and with less signs of disturbance, from their base to the sea.

"From the non-altered state of the laterite at its junction with the granite, and the imbedded fragments of the latter rock, as well as of fragments of the trap dykes, it may be inferred that both granite and the associated trap dykes were elevated in a solid state. I have classed the laterite as more recent than the Nirmul fresh-water cherts and limestones, on account of the latter rocks having been invaded and altered by trappean intrusion."

THE SCHOOL OF INDUSTRY.

THE School of Industry has been so repeatedly referred to that a passing notice of the establishment may be pardoned. In 1846 it appeared by returns made to Government that upwards of 200 boys, betwixt the ages of twelve and sixteen years, were picked up annually by the police, for the most part on charges of petty offences against property: and that those sentenced to punishment were in general sent to Gaol or the House of Correction, to herd with proficients in villainy, and return to the streets to resume depredations, hardened and perfected in crime. The bulk of these were orphans or destitutes. They had no one to advise them, look after them, or provide for them; and were in the majority of cases believed to have betaken themselves to thieving, either under the pressure of want, or at the instigation of more matured and hardened culprits, who meant to share in the spoils thus obtainable with comparatively little danger, as the punishment of children, even if detected, was not to be compared to what would have been inflicted on older rogues. A considerable body of gentlemen having subscribed for the establishment of a School of Industry, for the reception of juvenile culprits, sentenced by the Magistrates of Police, the Court of Directors were applied to, and at once conceded a Superintendent free of charge. Arrangements for starting the project were made in May 1850, and notwithstanding the interruption occasioned immediately afterwards by the Monsoon, the whole was in operation by January 1851. There are at present (May 1852) 56 boys on the list,—these live on the establishment, and are carefully looked after, clothed, and fed. They are taught reading, writing, and arithmetic, by a native schoolmaster, and instructed by workmen employed on purpose in any handicraft for which they feel disposed. The trades taught are brick-making and pottery-work, drawing, weaving, carpentry, blacksmith-work, both forging and finishing; brass-casting, and turning both wood and metal, plain weaving, on the native as well as the English fly shuttle loom, and coarse mat-making. They work from 9 A. M. till 5 P. M. daily —including in this the two hours at school, and are nearly all making more creditable progress. There being a demand in Bombay for the more common kinds of wood-cut and metal engraving, lithography, and simple colouring, five of the boys were selected for instruction in this,—it is the first department of the establishment that has met its own charges, and is now yielding a small profit to the School. Availing myself of the very trifling expense at which illustrations could be got coloured, (Rs. 1 a 100 on an average) I have indulged somewhat more freely them than I otherwise would have done, and have to bespeak the reader's forbearance with the quality of the work, considering the source whence it is derived. The youngsters now cheerful, well-behaved and happy, honestly earning their bread in furnishing illustrations to a treatise on geology, were a few months since the pests at once and victims of of society, living on plunder—their hand against every man, and every man's hand against them. At present they are only beginning to learn; but I have deemed the illustrations procured through their industry better than none at all; and it would scarcely have been worth while to have incurred the expense of providing them through the only other source at command,—that of regularly trained draftsmen.

ART. V.—*A report on the heavy rain in Scinde, in July and August, 1851, and its effects on cultivation &c., in the Kurrachee Collectorate.* Forwarded by H. B. FREERE, Commissioner in Scinde.

THE late heavy rain commenced almost simultaneously every where in the Kurrachee Collectorate on the 6th July last, and continued to fall with short intermissions, up to the 4th ultimo. Such rain, it is generally stated, has not been experienced in this province for at least thirty years.

2.—It may perhaps be worth noticing that throughout the above period (during which time I was occupied in visiting the Bunds &c., between Ghorabharree and Kotree near Hyderabad) I frequently observed, although a steady wind blew from the Southwest, the clouds invariably to come up from the East and Northeast, and to pass over the level country with a gyratory progression to the Southeast; apparently turned off towards the latter direction by the Western hills. When the wind blew only from the north there was generally a cessation of rain.

3.—The destruction of the Khurreef cultivation in the lower portion or Delta of the Indus, first occasioned by the extraordinary rise of the river must have been rendered complete by the subsequent rain, and as a consequence the scarcity of rice, the great material of food on which all the inhabitants of that part subsist, will be severely felt by the poorer classes.

4.—In the pergunnah of Ghorabharree the present Khurreef may be reported as entirely destroyed, and I believe much property has been lost or injured through the combined effects of the inundation and rain.

5.—The ensuing Rubbee may doubtless be plentiful, but the productions of that season in the above districts will not reconcile the cultivators to the loss they have sustained, or tend much to relieve those who are wholly dependent on the Khurreef for their annual subsistence.

6.—The town of Ghorabharree must have also suffered from the rain which fell, after I left it on the 9th of July. During my stay there,

I observed that its low situation rendered it liable to be swept away by an extraordinary rise in the waters of the Oochta and Sehwan, and particularly that of the latter branch. It was only saved this season by the vigilance of the Kardar, and the people who watched over the Bund raised for its protection, for I have seen the water rise to within a few inches of the top of the embankment.

7.—This town is made still more unfit as a place of abode, in consequence of the numerous pits and hollows, which the people have dug from the earth to build their houses; as many of these hollows are situated in the Town, and within the embankment from whence there is no escape for the accumulated rain water, until the river subsides; and then only a small portion can be let off; so that what with putrid filth, and stagnant water there is every reason to conceive that this place alone must engender and contribute to spread abroad much of that deleterious miasma which produces disease, suffering, and death.

8.—The practice of interment in the immediate vicinity, and often in the midst of towns so very prevalent in this country, but which I beg to submit, ought under no pretence to be tolerated, will, I fear, this season, also prove noisome, and injurious to those who are within reach of the pernicious effluvia arising therefrom.

9.—All the low grounds in the Pergunnahs of Syathree, Gharka, and Beronath have been flooded, partly by the river near its banks, but in the interior chiefly by the rain, and much cultivation has been destroyed—principally that of rice.

10.—The Saline matter washed down from the higher grounds, has also conduced to destroy, or as the cultivators say "burn up" a portion of the crops in these Pergunnahs.

11.—In Beronath however the land which has been inundated will afford an opportunity for extending cultivation as soon as the waters dry up, and the soil being of a better description than below, will probably yield a plentiful and valuable Rubbee.

12.—The Bughaur appeared to flow freely, and to draw in a supply of water which would have proved ample for the wants of the cultivated lands dependant on it in the interior, but the continued rain this season has in many instances rendered what would have been otherwise beneficial, either useless or only another source of misfortune. This branch however did not seem to me to indicate much the unusual rise in the

river so very apparent lower down, where it was found necessary to bund up the mouths of some canals, especially those drawn from the main river, and where others leading through low grounds, broke away or overflowed their spoil banks.

13.—I am informed that the low grounds near the banks, and at the extremity of the Kulree, in Sakra (where there are also a few dunds) were flooded to some extent, and much cultivation destroyed. Being prevented by the weather from visiting this district, and my attention having been called more towards the bunds on the main river I cannot state, from personal observation, what effects the heavy rain had on it. But if what I have heard is correct, the knowledge I have of this Pergunnah, induces me to think that there can be very little of the Khurreef saved; for the Salaibee or low grounds are almost the only portions ever much made use of, the remainder being nearly all crusted with the saline efflorescence, particularly abundant there, and which is usually found on level plains lying beyond the influence of the fresh water inundations or where land has been left untilled for a few years.

14.—The effects of the rain upon these lands will tend to improve, or, at least, render them fit for some crops; but I fear very little advantage will be taken of such places in Sakra. The great draw back is the expense attendant in raising the water for irrigation, and which has also been the cause of making that once fruitful district what it now is, merely a pasturage for cattle &c. When the Baghaur ceased to be the main channel of the river, and could no longer inundate the low grounds, it was wont to do, the cultivators left the district, and sought more convenient lands elsewhere.

15.—The lakes of Heelaya and Loneree, and the dunds &c., in the neighbourhood of Hallajee above Gooja, are reported to have been filled to overflowing by the rain torrents from the hills. They will leave room for much cultivation as their waters dry up. The fisheries also of these lakes &c., yielded something towards increasing the revenues formerly and will perhaps do so now after a time.

16.—The Veroo dund situated in the hills beyond the Wunyanee range, and about 16 miles west of Oonerpoor, was overflowed by the streams from the hills: and when I visited it last month the collectio, of water appeared to cover a space about four square miles—some other dunds in the neighbouring highlands were also well filled, but

the few zemindars about the place (chiefly of the Khosa tribe) who appeared anxious to profit by the opportunity thus presented to them stated that they were unable of themselves to cultivate so much available land, without some assistance from Government, and solicited loan of grain, or money. The former they said would be more acceptable, and which they could repay in kind more easily.

17.—The Veroo bund has been injured in the masonry parts built by Captain Partridge, and some of the cutcha portion has also been carried away; I beg therefore to submit that it is advisable, at least to restore it to its former state, which will cost about 200 Rupees.

18.—The Khurreef crops in the Pergunnahs between Tatta and Lukkee, have also suffered along the banks of the River; but the tract of land below the hills, made available for cultivation by the late rain, will I think make amends for the loss sustained. I found the people actively employed in tilling the latter, especially above Kotree, as far as Lukkee and the Kardars of Seree, Heelaya, and Jurruck stated that they had succeeded in getting a few spots cultivated in the highlands of their Pergunnahs.

19.—The districts of Sehwan were almost entirely overwhelmed by the united waters of the Indus, the torrents from the hills, and the intercurrent Narra. In fact, the whole country appears even at the present date, after the water has in a great measure subsided, a vast lake surrounded by an extensive swamp, and the villages and high ground as so many islands: many of the latter have only emerged since the 18th ultimo.

20.—The following are, as far as I can ascertain, the principal channels which bring down the rain water from the hills and highland west of the above districts, between Mullar and Shah Hoosein.

1. *Nan Gaj—with its branches Nace Tukkee and Naeesool.*—Falls into the Kholab Dow, and inundates both Mullar and Phooljee.

2. *Naee Naying.*—Descends near Shah Hoossein, and falls into the Munchar, also inundates Phooljee and Samatanee.

3. *Naee Ungaee.*—Descends near Shah Hoossein, and falls into the Munchar, also inundates Phooljee and Samatanee.

4. *Naee Nurree.*—Falls into the Munchar, and inundates Cocha.

5. *Naee Rookree, a branch of the Nurree.*—Also falls into the Munchar.

6. *Nœe Hullallee.*—Inundates Shah Hoossein and Chinnee.

21.—The greatest quantity of rain in these districts fell between the 18th and 29th July, and the night preceding the latter date is described by those who reside in the vicinity of the Munchar, and nearer the hills, to have been most terrifying. The heavy rain came down in torrents, or in the words of the inhabitants "the clouds were broken and fell" accompanied by incessant flashes of lightning and reverberating peals of thunder, until about midnight, when after permitting, as it were, these fear inspiring forerunners fully to announce their coming, down rushed the impetuous streams from the hills, frightfully swollen, and sweeping off every thing in their course towards the plains, where within a couple of hours, a depth of about four feet of water covered the high grounds, which had until then remained dry.

22.—Many villages in the neighbourhood of the Munchar lake (into which a great portion of the lands seems merged) have been carried off entirely or very much injured; and for many miles round Boobuk, the water even rose above the mounds on which the villages are generally built causing considerable damage to the houses, and the property they contained. Of those villages which stood on a lower level there are hardly any traces. It is also stated that boats of 20 khurwars passed over the streets of Jungar.

23.—Some lives have been lost, and cattle &c. carried away; but the greatest loss has been sustained in the public and private granaries, and Buttaee Khurrahs, which were either swept away or the grain damaged by wet. This will be felt severely by the zemindars, some of whom, I am informed, will in consequence be unable to cultivate to any great extent in the ensuing Rubbee without assistance from Government.

24.—The following are a few particulars of the losses &c. caused by the inundation of the river, and the heavy rain, which I have been able to collect on my way. A more full and detailed account I am told is being prepared by the several Kardars, which will probably take some time as many of the people who have suffered are still scattered throughout the hills.

Pergunnah Ghorabharree.—About 40,000 Beegahs of the Khurreef cultivation has been destroyed, and nearly 37 villages, but I have heard of no lives being lost.

Pergunnahs Syathree, Gharka, and Sakra.—The Khurreef crops in the low grounds to some extent.

Pergunnah Beronath.—The Khurreef crops in the low grounds to some extent, and about 10 villages.

Pergunnahs Seree, and Heelaya.—The Khurreef crops in the low grounds to some extent, and about 11 villages.

Pergunnahs Sonda and Jerruck.—The Khurreef crops in the low grounds to some extent, and about 9 villages.

Pergunnah Bada Kanote.—The Khurreef crops in the low grounds to some extent.

Pergunnahs Majinda and Noorpoor.—The Khurreef crops in the low grounds to some extent, about 7¾ khurwars of grain destroyed in the Bandas, and about 168 khurwars of grain destroyed in the Khurrahs.

Pergunnah Luckee.—The Khurreef crops in the low grounds destroyed to some extent, and about 17¼ khurwars of grain in the Bhandas; and 304 khurwars in the Khurrahs.

Pergunnahs Sehwan and Kurrumpoor.—Almost all the Khurreef crops—many houses in the town of Sehwan injured, and some lives lost.

Pergunnahs Eoobuk and Wut Jungar.—3611 Beegahs of the Khurreef cultivation, a great many houses injured, 2 lives lost, about 51 domestic animals, 25 khurwars of grain in the Bandas, and 410 khurwars in the Khurrahs.

Pergunnah Samatanee.—I could get no account of the injuries this Pergunnah has sustained, as the Kardar said he was not yet prepared to give the required information, but if I may judge from what I have heard this district seems to have suffered more severely than the rest.

Pergunnahs Turtee Vichola, and Khodabad.—760 Beegas of the Khurreef, and about 12½ khurwars of grain in the Bandas, but no lives have been lost nor any considerable damage done in these districts.

Pergunnah Phooljee.—About 57 Beegahs of the Khurreef cultivation, 2 villages, and a great many houses destroyed—7 persons drowned—48 domestic animals lost, and about 15 khurwars of grain damaged in the Bandas.

Pergunnah Dadoo Murkapoor.—About 108 khurwars of grain in the Khurrahs, and 40 in the Bandas destroyed, and damaged by wet, otherwise this Pergunnah seems to have suffered but little.

Pergunnah Mullar.—39 Villages with their surrounding cultivation entirely destroyed, some grain damaged in the Bandas, the amount of which has not been yet ascertained. Of its principal town Gharra the Government Bungalow, Ambarkhana, and a few Banyan's huts are only left.

25.—I have heard from the Kardar of Samtanee, that when the Zemindars and others, were obliged to fly to the hills with their families and cattle &c., the Mohannas or boatmen compelled them, in some instances, to part with the half of their property before they would afford the distracted people the assistance they needed : and that those who had nothing worth dividing were forced to give the nose rings and other ornaments which their females happened to wear. I have nowhere else heard of such unfeeling behaviour on the part of the Mohannas, but if true ought surely, to be discountenanced. It is probable however that the Kardar received an exaggerated statement of what has occurred, and is at present unable to discover the truth as the individuals who are said to have suffered in the above way, are still living in the Hills, whither they, as well as many more of the inhabitants of the low country have taken refuge, and where only they can at present find safe pasturage for their flocks and herds.

26.—With regard to cultivation generally or rather throughout the Collectorate, I am inclined to believe that although the Khurreef has suffered, the crops of that season together with that of the following Rubbee will, when united, be found more abundant than those of late years, that is provided no further misfortune happens to them. But I beg to submit it will be necessary to assist those cultivators who have been unfortunate in losing their grain.

27.—The extensive submersion the country has undergone, will, there is no doubt, improve the soil, and render many parts which were before unfit in a measure available for tillage ; but much sickness, I fear, will also rise from the wet state of the ground every where, and especially in townsa and villages where filth abounds. As it is, fever and dysentery, even now prevail in the districts of Sehwan, and that fearful scourge to mankind the cholera still lingers here and there.

28.—The roads have been destroyed and rendered impassable to camels nearly everywhere throughout the collectorate ; and it is utterly impossible to travel by land in the Sehwan districts now. The mode

of access left from one village to another is by means of the small flat-bottomed boats which require very little water.

29.—Coming up the country by way of the Indus in country boats is at present both unpleasant and tedious for there is no regular wind, and the river banks are everywhere flooded, which renders tracting difficult and often impossible. It may perhaps be worth noticing here that the southerly winds which generally prevail in the lower portion of the Indus, seem to forsake it above Majinda, between which town and Sehwan I have only got as far as two miles in as many days, but boats go down rapidly enough.

30.—I was told at Sehwan that goods sent from Kurrachee to that town at this season, are frequently conveyed by the hill road in about eight days, and sometimes even in six, whereas they often take more than three weeks coming up by the river. I have travelled up by the above route, and am led to think that if a good road were made with substantial bridges over the streams, it would prove very beneficial to that part of the country. The great heat which makes travelling in the level country so distressing, if not injurious, is seldom felt in the high lands. As a proof I may state what is well known, that many from the former betake themselves to the latter during the hot season, and find abundant pasturage for their flocks and herds.

31.—All the bunds along the banks of the river and elsewhere are either carried away or seriously injured, and it will be necessary to form fresh ones next season. The canals (many of which cannot now be traced in the districts of Sehwistan) will also require to be cleared of a great deal of deposit, and earth washed in by the rain from the spoil banks. I cannot now form any estimate of the probable expenditure for the ensuing year until the waters subside; but I hope by the end of next month to be able to lay before the Collector a more detailed report on these works.

Camp Joee, 5th September, 1851.

(Signed) G. ELANDER,
Assist. to Collector for Canal Clearances.

True Copy. (Signed) H. W. PREEDY, Captain,
Collector.

True Copy. H. B. ELLIS,
Assistant Commissioner.

Extract paras 2 to 16, from a letter from the Deputy Collector of Customs, No. 239, dated the 23rd August, 1851.

2.—I beg leave to submit to you that during the entire period I was resident in Kurrachee, and that any remarks or suggestions, I have to make, must be solely of a local character.

3.—The loss of life and property which occurred may be attributed to two distinct causes—1st, the flood, and 2nd, the rain; each of which calamity (for such they must be considered) deserves a separate notice.

4.—The Learee which enters Kurrachee harbour is a mere mountain torrent; as a general rule, speedily rising and speedily exhausting itself. It discharges itself by two channels, the smaller of which passes close by the town, and from the wells in which the chief supply of water for drinking purposes is obtained by the inhabitants. To the over-flowing of this channel the flood is to be attributed. It is said, that with the view of securing a good supply of drinking water, some of the inhabitants cleared the land away in the bed of the river where it branches, so as to lead the stream towards the town: this may, or may not be true. That the main body of the river took this direction contrary to the custom of former years, is beyond a doubt, and for its advent neither the authorities nor the inhabitants appear to have been prepared.

5.—The injury that resulted was confined to the suburbs of the town; the main road had to be cut through in two places to allow the water to flow off, and walls and houses of sun-dried brick were levelled with the ground, especially so where the foundations were composed of the same material.

6.—The fishing village or the Muchee Meanee, as it is called, was exposed to great danger; but a short time previous an earthen bund had been erected (in anticipation of the rising of the river) from the north-west bastian of the town to the harbour side, and thence to the bunder road, so as to confine the river to its bed on one side, and thence to the bunder road, so as to confine the river to its bed on one side, and to keep the salt-water from transgressing its limits on the other. This barrier, however, either from having been badly constructed on the river side, or from not having had time to consolidate, was speedily burst through, and the lower parts of

the village were flooded to the depth of several feet. The fishermen by cutting through the barrier in front, and thus allowing the water to flow uninterruptedly prevented any loss that might otherwise have ensued.

7.—All this, it is my belief, might have been avoided, had the proper authorities taken the precaution of clearing the land, which accummulated during the past year, from the main channel of the Learee, where it branches, but the fact was the season was an unusual one, and previous experience led to a belief that no danger was to be anticipated from such a cause.

8.—Between three and four hundred houses are reported to have fallen, or to have suffered so much damage that their removal was deemed advisable, the greater part of these were beyond the influence of the flood: and their destruction must be attributed solely to the rain.

9.—This extent of loss, caused by the fall of less than thirty inches of rain, will naturally draw attention to the manner of building here; and to the materials of which houses are composed, and to this subject I must devote a few words.

10.—The better class of Scindee houses have substantial stone foundations; the frames are of the Baubool or even better wood, and to support a coating of prepared mud with which they are covered, the short wood of the country, either tamarisk or mangrove, is made use of, as laths are in houses of English construction. The roofs are flat, and are protected with mud only. All the houses of this class which suffered were old and dilapidated previous to the rain; the removal of them was a benefit to the public.

11.—The chief sufferers were parties who have only known the country, since British occupation, and who built for the climate as they knew it. Some of these built after the style most familiar to them—that of Bombay and the Concan, which is a highly pitched roof, with a covering of tiles, and calculated for such a fall of rain, as the western coast of India is annually subjected to. Others adopted the flat roof after the manner of the natives of the country, and for additional protection covered it with a slight coating of chunam. Such roofs invariably leaked, and in a few instances the water got into the walls and rendered the houses at once unsafe, some of them fell to the ground—in one

instance causing loss of life. It has since been brought to my notice that the roofs of such buildings were faultily constructed, and to it their destruction is attributed.

12.—A flat roof is much more attractive in appearance than a tiled one, and it is better adapted to a climate like Scinde. The city of Calcutta has been called the "City of Palaces," and much of the beauty of its appearance is to be attributed to the style of its architecture. Every house has a flat roof, and although the site is low and badly chosen, which renders the drainage defective, and the annual fall of rain far exceeds any we have yet experienced in Scinde, yet we never hear of houses being washed down as was the case here. I should also add that stone for building purposes not being procurable, every house is of necessity made of brick.

13.—It is very generally remarked here how well the houses with high-pitched roofs withstood the rain. The buildings adverted to, have no pretensions to architectural beauty; being little beyond barns in external appearance, and they cannot be considered suitable to a dry hot climate, which that of Scinde undoubtedly is, yet it is not improbable that consequent on the late visitation of rain many will adopt this homely style to their own discomfort, and to the injury of the appearance of the place.

14.—Perhaps the best roof that could be adopted in Kurrachee is a medium between that of Calcutta and Bombay, with the gentle slope always seen in Italian villas. It has been already partially patronised, and I am informed has been found satisfactory in all weathers.

15.—The visitation of which we complain has brought with it at least a measure of good. For the past five or six years little rain fell, and people apparently began to think that a shelter from the sun combined with a decent external appearance was all that was necessary to constitute a house; buildings were run up of the most flimsy character, and their construction was left to contractors who made a profit by using the worst materials. After what has occurred it is to be hoped, that more attention will be paid to a subject of so much importance in itself, and with which health and even life are so intimately connected.

16.—In conclusion, I have to add that as yet the town of Kurrachee is unfurnished with drains, their immediate construction is not of

absolute necessity, and the subject will doubtless engage at a fitting period the attention of the conservative committee.

True Extract. H. B. ELLIS,
Assistant Commissioner.

Extract paras 1 *at* 32, *inclusive, from the Post-Master, Central and Lower Scinde, dated the* 28*th August,* 1851.

1.—Adverting to your endorsement No. 1521, on circular No. 1520, dated 5th instant, I have the honor to submit embodied all the reports received from my Jemadars and Cossids, on the general state of the country after the late heavy rains.

Roree to Hyderabad.

2.—The whole of this line is stated to be in a very bad state, several portions of the road have been most severely cut up, particularly about the village of Kurreem-ka-gote, where the water covered the post road to the depth of one and a half feet for thirty miles.

Bridges.

3.—The Jandraoow and Nusseerwow bridges, near the village of Sungrassee, have been completely carried away. Boats for the purpose of crossing the mails over these two nullahs were in use during the period the rains lasted.

Destruction of Houses.

4.—Twenty good-sized houses in the city of Khyrepoor have fallen, resulting in the loss of four lives. Khyrepore is completely inundated, and what was at one time a town is now a large sheet of water—of course deserted by all the inhabitants. The huts occupied by the Dak-horsemen at the stations of Bobree, Soee, Gopass, Boomba, and Peer Hussun have all been swept away.

Cattle.

5.—The loss of cattle between Roree and Hyderabad on the Dak-line appears to be inconsiderable; the Post horses have suffered a good deal, in consequence of occasionally falling into pitfalls, the road not being discernible.

Agriculture.

6.—At Sungrassee, five fields have been completely submerged, and grain to a considerable extent injured; at Noonarree a large tract of

land has fallen into the Fullallee, caused by the giving way of the river banks.

General state of the country.

7.—The country throughout the whole line of road is said to be in a most deplorable state; the loss of property, grain, &c., belonging to the inhabitants of the several villages immense; and although only four lives are stated to have been lost, there is every reason to conclude the casualties during the late heavy rains, and unprecedented rising of the river, have been more numerous.

Travelling of the Mail.

8.—During the continuance of the rain, the contractor Sheikh Ally was not able to perform all he had promised to Government, nor was it to be expected under such untoward circumstances. He could run six miles per hour; however, since the cessation of the rains he has more than acquitted himself to my satisfaction, and so soon as the "Travelling Returns" are prepared and submitted to you, I have no doubt you will see Ally is deserving of every encouragement.

ROADS.—*Oomerkote Road.*

9.—The Post line on this route appears to have equally suffered with that of Sukkur, at a place called Cooba,—distance twelve miles from Hyderabad. Water has been reported on the road for one mile to a depth of four feet, repairs here are immediately necessary.

Bridges.

10.—Near Allyar-ka-tanda three bridges called Goura, Emawah, and Khasaull, and likewise one at Meerpoor and Buttoorah, were swept away by the floods. All those bridges, I learn, have since been re-made by order of the Deputy Collector (Lieutenant Hodgkinson) at Meerpoor.

Houses.

11.—The number of houses destroyed are reported by the Jemadar to be 32, viz: at Allyar-ka-tanda twenty, and at Meerpoor twelve, besides which, the fort at the former named place has given away.

Loss of lives.

12.—By the falling in of the roof of one of the houses at Allyar-ka-tanda, unfortunately twelve lives were sacrificed; viz: six men, three women, and three children—the accident having occurred at night, when the immates were all asleep.

Cattle.

13.—The cattle have suffered much, numbers have perished, and others are in a very sickly state.

Agricultural prospects.

14.—It would appear from the information I have been able to gather from the Jemadar on this line, that the fields and their produce have suffered no damage whatever; on the contrary, it is stated, cultivation was never in so flourishing a state, and the grain in excellent order; grass fodder for cattle is represented just now to be rather scarce, and of inferior quality.

General state of the country.

15.—On the whole, the general state of the country between Hyderabad and Oomerkote is mentioned as being in a most favourable state for agricultural purposes, notwithstanding the inhabitants have suffered to some extent, as regards property; and all the cultivators seem grateful for the copious rains which have fallen in this hitherto barren tract of country.

Wells.

16.—The want of a well at the Attanah Chowkey, is severely felt by the Cossids: this work was some time since, I believe, ordered by you to be progressed with.

Luckput to Tatta.

17.—The rain has been very heavy on this line, but as the Dak passes through the Runn or salt tract, which is a complete desert, bare of any description of cattle or cultivation for 30 miles. The rains have only affected the country between Muggurbee and Tatta. All the bridges over the nullahs have been swept away. Fields of Rice and Bajree submerged. An estimate of the loss of property cannot be correctly ascertained until after the subsiding of the waters.

Cattle.

18.—The Dak contractor informs me, the cattle, particularly bullocks, and goats, have suffered much.

The Dak.

19.—Between Sadhan and Mirza-ka-gote, a boat is now employed for the purpose of conveying the mails—the waters rising to a height of 5 feet.

Alteration of the Post-route.

Hyderabad and Kurrachee.

20.—The Post line on this route has been carried on an average of from three to five miles inland, along the adjacent hills, with the exception of the part lying near Heelyah,—it having been found quite impracticable to retain the old route, for the river Indus has, in its late uncommon high rise, assisted by the unprecedented rain, cut its way into the country for miles, inundating vast tracts of land, destroying extensive crops of grain, and other cultivation.

A Boat employed at Banan.

21.—At Banan, a boat was constantly employed for the conveyance of the mail, a thing which never before occurred.

Bunds.

22.—The Bunds have broken close at Sheikh Bhadan, flooding all the country between that and Tatta, and extending to Gharra, particularly at a place between Cheyliah and Chuttur-ka-gote, where I have been under the necessity of having a boat and two extra runners on the high road.

Villages submerged.

23.—In this part of the country the inhabitants appear to have suffered greatly. All the small villages eastward of the road being either entirely swept away, or deserted by the inhabitants.

Temporary alteration of the Post-line.

24.—From Tatta to Gharra the Post-line was altered during the rains, but now replaced. Two extra runners were placed on this portion of the road, and still remain, in consequence of the heavy work, wading through the water at parts three feet deep.

Gharra-creek.

25.—The rush of fresh water into the river Indus, down the Gharra creek, has completely thrown back the salt stream, and to understand fully the force of the fresh current, I may use the Jemadar's own expressive words, "There is now no salt water in the creek; it is all fresh and good for men to drink."

Loss of life.

26.—At Goojah, 2 lives have been lost, in the Culleerah nullah.

New road destroyed.

27.—The new road between Goojah and Tatta is destroyed,—no vestige of it remains.

28.—Between Gharra and Wuttajee-ka-landee, the Post road is through the hills. All the nullahs are full, but no obstruction of consequence was ever experienced here.

Travellers' house fallen down.

29.—At Wuttajee-ka-landee the poor travellers' house lately erected, has fallen down.

30.—From Wuttajee-ka-landee into Kurrachee, the whole road was one continued flood. All traffic suspended; and it was only at a great deal of labor and difficulty the mail was passed along. The four large water courses between Peeprie-ka-landee and Mulleer, remained full during the continuance of the rain—a thing unprecedented.

Mulleer.—Huts destroyed.

31.—At the Mulleer river a vast deal of damage has been done; the banks were completely overflowed, and the flood rushed into the country sweeping every thing before it. All the huts belonging to the shepherds or camel-men near the river were ungulphed—Life has been lost to some extent, and the destruction of cattle great.

True Extract. H. B. ELLIS,
Assistant Commissioner.

No. 1520 of 1852.

Circular, General Department.

From the Commissioner in Scinde,

To all Collectors, and Captain of Police.

Dated 5th August, 1851.

SIRS,—As the present season has been in many respects of a very unusual character, I shall be much obliged, if after the cessation of the present heavy rain, you will favour me with a report embodying any particulars you, (to the Collectors) "and your Deputies" (to the Captain of Police) "and your Lieutenants", may think worthy of record, and likely to be of interest to Government regarding the quantity of rain, its effect on the cultivation and the health of the people, the loss of life and property, public or private, and the interruption to communication it may have caused—with any practical

suggestions, which may occur to you in consequence, relative to the construction of public buildings, roads, bridges, &c., and the present provision for retaining rain-water for drinking purposes, where river-water is not to be had.

Kurrachee, 5th August, 1851.

I have &c.,
(Signed) H. B. E. FREERE,
Commissioner in Scinde.

No. 1521 of 1851.

General Department.

True copy of the above forwarded to the

Surgeons in charge of Staff and Civil duties.
Superintending Engineer.
Major Jacob.
Post-Master, Central and Lower Scinde.
Forest Ranger.

with a request that he will favour me with any details he may think of interest, on the subjects noticed.

Kurrachee, 5th August, 1851.

(Signed) H. B. E. FREERE,
Commissioner in Scinde.
True Copies. H. B. ELLIS,
Assistant Commissioner in Scinde.

From the Staff Surgeon,

To the Commissioner in Scinde.

SIR,—I have the honor to acknowledge the receipt of your circular to Collectors, No. 1520 of 1851, dated 5th instant, with accompanying memo. from you, requesting me to report on any of the subjects noticed, that I might think of interest.

2.—Of these subjects I propose shortly to remark.—1, On the quantity of rain fallen.—2, Its probable effects on the health of the people.—And lastly, on the provision for retaining water for drinking purposes, where rain-water is not to be had—the other subjects coming more legitimately under the department of the Collectors, will be more fully and ably reported on by them.

1st.—The quantity of rain that fell from the 5th of July to the 3rd of August, was altogether 22 inches 19 cents, a very unusual quantity for Kurrachee; and from all accounts the fall elsewhere throughout the

province was equally great. We have no record beyond 1839, but the oldest native inhabitant scarcely remembers such a fall; some few having an indistinct recollection of something like it, about twenty years ago. That the quantity has been very unusually great is proved by the face of the country being broken up by water courses, where flat, even surfaces previously existed, and by the beds of nullahs being widened and deepened much during the fall.

2nd.—It is a general opinion both amongst natives and Europeans, that an unusually rainy season is generally followed by unusual sickness and 1843, and 1846 are quoted by the latter as examples; but I believe that the time of the fall has more to do with the production of sickness than the quantity; for if it happens early in the season, as our late fall did; and, if it is followed by strong westerly winds, an tolerably clear weather, and the water is well drained off, and evaporated before the heat of October, my belief is, that there will be little increase of sickness—the sources of malaria not being much greater than those operating every year on the subsidence of the Indus.

3rd.—As far as I can learn, the fall of this year has caused as yet no unusual prevalence of fever (the disease chiefly to be expected), in the town or bazaar of Kurrachee, and I have made every enquiry.

4th.—In the parts of the province far from the Indus, it would undoubtedly be a great blessing for the towns and villages to have properly constructed tanks, for preserving the water during the occasional falls of rain, for domestic purposes; but I think, the advantages of such tanks at Kurrachee would be counterbalanced by these tanks affording an additional source of malaria; and I am inclined to this opinion from the circumstance of the neighbourhood of the Rambaugh tank being notoriously unhealthy; and it is more than suspected the Rutchee tank, the only other one in our neighbourhood, is the source of unhealthiness to the houses in its proximity; and whilst the supply of good water from wells is so abundant, I think the policy of forming tanks may be very doubtful, as, under any circumstances, they would afford an additional source of zymitic disease. These observations of course apply to the immediate neighbourhood of a large cantonment like Kurrachee—at some distance, and in a proper direction, with regard to the prevailing winds, tanks might be formed to afford many advantages.

5th.—But I trust these will be soon less required, if the plans of the Executive Engineer, for supplying water to the town and harbour, are carried out, and followed by an aqueduct on the same principle to the bazaar and barracks. It has been clearly proved, that such would be an immense saving to Government, while the advantages to a large and increasing population, and to a large cantonment, would be incalculable.

6th.—To conclude, I may adduce as a proof of the questionableness of establishing tanks at Kurrachee, that in some of the topographical reports in the medical and physical transactions of Calcutta (to which I have no opportunity of referring for particulars), it is asserted that the station of Neemuch was long believed to be the healthiest one in the Bengal presidency, until the establishment of bunds and tanks for gardening purposes, when, fever, previously scarcely known, began to be common."

Camp Kurrachee,
29th August, 1851.

I have &c.,
(Signed) J. Don, Staff Surgeon.
(True Copy) H. B. Ellis,
Assistant Commissioner.

To, H. B. E. Frere, Esq.,
Commissioner in Scinde, Kurrachee.

Sir,—With reference to your circular No. 1520, of 1851, dated 5th August, a copy of which was forwarded to me, with a request that I would favor you with any details I might think of interest on the subjects noticed, I have the honor to inform you that the quantity of rain which has fallen in Shikarpore, within the last three months, has only amounted to two inches and two cents, which fell in the month of July; and that from the information that I can collect, it does not appear that it has produced any prejudicial effect on the cultivation or the health of the people. I cannot ascertain, that there has been any loss of life, nor am I aware that private property in this place has sustained any injury, except in the downfall of a very few rudely constructed or dilapidated buildings.

2.—Although the rain which has fallen in Shikarpore has occasioned little or no detriment to the interest of the population, I would beg

leave to observe, that the undue superabundance of inundation from the river has, from the information I have received, been detrimental to the cultivation of the lands which have been flooded. In consequence of the almost unprecedented extent of inundation in Upper Scinde great sickness is, I fear, to be apprehended from all classes of the population, and with a view to meet the emergency, I have applied officially both through the military and medical authorities for an increase of medical officers and medical subordinates, and an extra supply of medicines.

3.—As I am, generally speaking, precluded by my official duties from any inspection, of the interruptions to communication between the several adjacent stations, as well as of any public buildings, roads, bridges, &c., and the provision for retaining rain-water for drinking purposes; I do not feel competent to offer any opinion on the subject. But I hope, that I here may be allowed respectfully, and with due deference, to submit for your consideration whether or not it would be advisable to prolong, in situations where it may be practicable, the extension of the present constructed canals into uncultivated parts, without expense to Government, by offering to wealthy natives the free cultivation of land for a certain period of years, at the expiration of which a certain rate per Beegah might be fixed by Government; and in granting this concession, I would beg leave to suggest that on the land so cultivated Cotton alone should be grown, for which species of produce the soil of Scinde appears to be peculiarly adapted.

I have &c.,

(Signed) H. R. ELLIOTT, Staff Surgeon,
In charge Civil duties, Shikarpore.

(True Copy) H. B. ELLIS,
Assistant Commissioner in Scinde.

Hyderabad, 11th August, 1851.

Sir,—In reply to your circular No. 1520 of 1851., I have the honor to report that the weather during the last two months at Hyderabad has been very oppressive. This is generally the case at this station in the month of June, for although the temperature of the atmosphere is not higher than in the two preceding months, it is so moist that little or no evaporation from the surface of the body takes place, neither can the air be artificially cooled, more especially as

it is generally calm. The hot wind generally begins to blow at Hyderabad about the 6th of April, lasting about six weeks, and is called by the natives the "Chalees-din ka paun." This season however it did not commence for a month later, and only continued a short time, although the langour and debility which every one, more or less, has experienced here for the last two months, are chiefly to be attributed to the depressing influence of the high temperature; something may be attributed to another cause, for the moisture of the air, which diminishes the evaporation from the skin, facilitates the passage of electricity from it;—moist air being a good conductor. The air in the cold season on the other hand, being very dry, is the reverse, and the body becomes charged with it on the same principle that the hair of a person, when isolated and charged with electricity from the machine, crackles when rubbed, and stands on end, showing that the fluid is in excess, or the body is positively electrified.—This is familiar to every one here in the cold season.

2.—During the continuance of this weather, the air is bracing and exhilirating. And even in March, April, and towards the latter end of May, when the air is still dry (though less so than in the cold season), although the temperature is high, yet, if there is no exposure to the sun or hot winds, the climate is not unpleasant nor unfavorable to health.—But in June, and generally in the first half of July, the air becomes filled with moisture, which is prevented from deposition by the high temperature; langour is felt, the system becomes depressed and predisposed to disease. Fortunately, at this season there is no malaria to occasion fever, but cholera generally makes it appearance, as it did this season in the end of May, and continued during the month of June.—In the cold season I have never seen nor heard of a case of this disease. Most of the Europeans suffered much from irritation of the skin, and a good many were affected with painful biles,—from this the natives were not exempt.—About two inches of rain may generally be expected at Hyderabad in the month of July, but this season 9·99· fell at Kotree (where a register has been kept) between July 10th and August 4th, inclusive. The showers were heavy, but of short duration—northerly winds prevailed during this time. From the houses being built of unbaked bricks many have been damaged, some fell down, and several accidents occurred; one woman was brought to

the General Hospital severely bruised, whose husband was killed at the same time,—another patient had his thigh fractured.

3.—As there is no jungle, and very little cultivation in the neighbourhood of Hyderabad, any rain which falls with the exception of what flows into the nullah, filled from the Fullallee, soon dries up. The town from its situation, on the crest of the limestone range, is easily drained, and well exposed to the air ; so that there has been no increase of sickness. There has been a greater number of prisoners affected with fever, however, since the rains ceased ; on the 4th instant there were twelve cases in Hospital; to-day there are twenty. The prisoners are now divided between the new jail and tents pitched near the Belooch pendalls—the proportion of admissions has been five to forty four.

4.—The troops here are all at present very healthy ; the 28th Regiment N. I. remarkably so;—the other day there were only twelve trifling cases in Hospital. Since the 4th instant, there has been a steady breeze from the southwest, and as the air is comparatively cool and dry, the change is very refreshing.

5.—As the Indus has this year risen higher than usual, some increase of sickness may be expected at its subsidence, but, I believe, that much depends on the state of the weather at that time ;—if the air is calm the miasma collects over the river and numerous canals when drying up, but if there is any wind it becomes dissipated through the air, and like a minute quantity of poison in a large quantity of water comparatively inocuous.

6.—I have observed that after a close, calm day, the exhalation does not extend above the height of ten or twelve feet from the surface ; the smell being very disagreeable. If there had been any wind, none was perceptible.

I have &c.,

To the Commissioner in Scinde. (Signed) JOHN CRAIG,
Assistant Civil Surgeon.

(True Copy) H. B. ELLIS,
Assistant Commissioner.

No. 1199 of 1851.

General Department, Public Works.

To, H. B. E. FRERE, Esquire, Commissioner in Scinde.

Sir,—With reference to your Letter No. 1520, dated 5th instant, I have the honor to transmit reports as per margin.

Lieut. Fife's No. 381, dated 15th August 1851.
Capt. Wemyss' No. 486, and 512, dated 7th and 23rd.
Capt. Hill's No. 700, dated 19th August, 1851.

2.—*Lower Scinde.*—Captain Hill is rather hard on the neglect which has been paid to annual repairs here. I can only say that on my arrival in October last, I requested him to point out what was required, and he stated that none were required. I therefore have no share in any blame which may attach to his recommendation being overlooked.

3.—With respect to roads in cantonments a sum of twelve hundred Rupees per annum has been allowed, to be disbursed by the Brigadier, but by some oversight this sanction was not communicated to the parties concerned, until lately; and I believe Government declined to allow the arrears to be expended.

4.—On the whole, the damages to Civil and Military public buildings in Kurrachee, have been very trifling, when compared with the destruction of private property.

5.—*Upper Scinde.*—No serious damages occurred in Upper Scinde. The portion of the bund alluded to by Lieutenant Fife at Syndabad, and Baboorie has never been properly completed, and indeed as respects the cantonments at Sukkur, this portion of the bund is of minor importance.

6.—With respect to the 6th para, I feel almost certain that the breach in the great Abad and Jafferabad bunds, which was made at the requisition of His Highness, Ali Moorad, had been closed in some temporary way, and the water was thus prevented running down to Luckie. It is quite evident that water will spread however violent the current may be, if it is not supported on both sides by material banks. The direction of the current, only so far affects the flooding, as it cuts away the high banks, which have been formed, and lets the water over the low land behind; this however becomes a most serious

question, as much of Scinde lies below the level of the river, and the course of the river is practically uncontrolable.

7.—*Central Scinde.*—Captain Wemyss' letters are very vague. The proposition to bridge the canals permanently along the lines of road has often been made before.

8.—Captain Wemyss has sent me estimates for re-roofing the Belooch Battalion lines, amounting to..... .....Rs. 6,356 0 0

Repairs to Government-House stable.....193 5 0

Ditto ditto building... ...143 12 11

337 1 11

Other buildings and works, such as pendalls and drains in the Fort.... .... 1,369 13 1

Repairs to buildings in Kotree Fort. 169 11 9

The first item is however for an entire new roof to the pendalls which cannot be called strictly a rain damage.

9.—It appears therefore that Hyderabad has suffered more than I expected, but most of the repairs are to works of trifling importance;—such as Sepoys' Lines &c., in the Fort, works built in a hurry, and with unseasoned timber.

10.—Looking to the great importance of the communication between Kurrachee and Central and Upper Scinde being kept open in all weathers, and to the very considerable expense which will be incurred in making a road between Kurrachee and Tatta, it seems worth consideration whether it would not be well to return to the consideration of the hill-road, which, although objectionable in some respects, is over higher ground, and might therefore be made at less expense.

11.—Until some arrangement has been made to place adequate Assistants at the disposal of the Superintending Engineer, it is impossible to undertake any project of this nature. It is quite clear to me, that both lines of road to Hyderabad, and indeed, I may say, that all important lines of communication ought to be fully considered and laid down on paper, in the first instance.

12.—I fancy, every person has seen lines laid down, as a mere makeshift, in the first instance, on which money has been laid out year after year, until they cost a sum which induced Government to adhere to

defective line, rather than to abandon all which had been already
ne, and to commence *de novo*.

Kurrachee, 25th August, 1851.

I have &c.,
(Signed) WALTER SCOTT, Lieut. Col.,
(True Copy.) H. B. ELLIS,
Assistant Commissioner.

No. 381 of 1851.

General Department, Public Works.

To the Superintending Engineer, Scinde, Kurrachee.

SIR,—I have the honor to acknowledge the receipt of your letter No. 765, dated the 7th instant, and accompaniment; and to report that with the exception of the Sukkur Chowry, which is built on ground impregnated with salt, and an old building at Khanghur, no serious damage has been done by the rain to the public buildings in Upper Scinde. What injuries have been brought to my notice have resulted from the destruction of the wooden spouts by the white ants, and the cracking of the terrace roof, which breaks the plaster near the walls. To attribute the small extent of damage to the extraordinary tenacity of the clay of which the walls are built, I believe that it would require heavier rain as has not occurred in Upper Scinde within the memory of man, to destroy the mud walls of buildings, which are regularly kept in repair.

2.—This appears to be corroborated by the fact, that the clay walls of old, roof-less Musjids, are to be seen in various parts of the country where the great age of the walls being distinctly proved by their decayed ornaments.

3.—The first of the evils viz., the destruction of the wooden spouts by the white ants is at once met, by using earthen ones, which, I think, you will have observed, I have mentioned in some of my late designs. The second evil, has no cure, but in the reconstruction of the roof on a different principle.

4.—The extent of the damage to public works cannot yet be ascertained, but I am happy to report that nothing has occurred of a very serious nature. A flood from the Bholan pass inundated the outpost

of Khyree Ghurree, and many of the buildings will probably have to be reconstructed, but they are neither large nor numerous.

5.—The Bund between Sukkur and Syndabad was broken through twice. The water rose to within a foot of its top, and as the wind at the time blew hard from the eastward, the waves broke through. The repairs of this portion occupied about ten days. The water also threatened to carry away the bund at Baboorie,—this portion was however also secured.

6.—A singular instance of the uncertainty of the inundation, extending over a portion of the country known to be low, occurred during the early part of the season. Though the river was high enough to escape over its banks—both at Kusmore and Ghotkee—it did not make its appearance in the Lukkee basin until very lately. The extent of the flooding at different places along the banks, appears to be dependent on the direction of the stream at those places. This uncertainty of the inundation is a most important point, when considered with reference to extensive public works, on ground at all liable to submersion; as, for instance, the proposed road, between this place and Sukkur. If during an unusually high flood the effect of this change in the direction of the stream is sufficient to prevent the submersion of land flooded during ordinary inundations, what might its effect be supposing the direction of the stream to favor the submersion of the land?

Shikarpoor, 15th August, 1851.

I have &c.,
(Signed) J. G. FIFE, Lieut.,
Ex.-Engineer, Upper Scinde.

True Copy. (Signed) WALTER SCOTT, Lieut. Col.,
Superintending Engineer in Scinde.

(True Copy) H. B. ELLIS,
Assistant Commissioner in Scinde.

No. 486 of 1851.

Military Department, Public Works.

To Lieutenant Colonel SCOTT,
Superintending Engineer, Scinde.

SIR,—The rain now having apparently ceased, I am able to give you

a of the injury caused thereby to Government works, and

om the river having risen entirely over its banks, much damage caused, which I have repaired as far as possible to prevent ig done.

have already exceeded the amount of my estimate by L 7 for preserving this bank, and I have therefore to request tion to expending a further sum of Rupees 400 to repair the lready done.

hall require at a rough estimate Rupees 1,000 to put it in ler, but the above sum I require to go on with.

e rise of the river has been greater than it was ever known ie road by the Artillery stables is impassable even now, and a of the bank beyond the entrenchment, where it has not been , has been carried away.

e Horse Artillery lines near the Commissariat Store-room, red much damage, the entire roof having fallen; a small por- square feet, is to be stripped and re-roofed, is included in my pair estimate, but it would be useless to do this now unless I sanction to re-roof the entire building,—this will require Ru- more.

ro of the Artillery pendalls have suffered a good deal; these ire not occupied, and most probably will not be required again.

e Commissariat godown is much damaged, but more by white by the rain; this building is infested with these insects, and recommend this building being abandoned and a pucka built, for the stores of the Commissariat, or one of the Euro- acks might be roofed in, and given over to the Commissariat nt for that purpose. To repair the godown properly, will Rupees 800 to 1,000, and even then it would not last any out repairs. I think a Barrack would be convenient in , as large quantities of stores are being daily carried up to acks.

e 28th Regiment N. I., pendalls have also suffered considerably, in the roofs, you are perhaps aware, is very old, and from the

quantity of rain that has fallen, all the roofs are more or less seriously damaged. I think it would be a false economy, repairing a portion here and there, and would strongly recommend the re-roofing of the entire buildings,—the cost of this will be Rupees 5,804. This is calculating that about one fourth of the beams are serviceable, and also slight plastering to all the walls outside. The rafters are, I may say, rotten, and unserviceable; the verandahs, which have been lately added to these pendalls have answered well, in every respect.

10.—I will send you as soon as I can a further report on the state of the 2nd Belooch Regiment pendalls, which are in a very bad state; of the new European Barracks and Hospital, as well as of the different buildings in the fort.

Hydrabad, Ex.-Engineer's Office, 7th August, 1851.

I have &c.,
(Sigd.) F. WEMYSS, Captain,
Ex.-Engineer in Scinde

True Copy. (Signed) WALTER SCOTT, Lieutenant Colonel,
Superintending Engineer in Scinde

(True Copy) H. B. ELLIS,
Assistant Commissioner in Scinde.

No. 512 of 1851.

Military Department, Public Works.

To Lieut.-Colonel SCOTT, Superintending Engineer, Scinde.

SIR,—With reference to the Commissioner's letter, No. 1520, of the 5th instant, a copy of which accompanied your circular memo. No. 1078, of 1851; I have the honour to state that but trifling damage has been caused to the buildings in the civil department within the range of my control, as far as I have as yet heard.

2.—The only civil buildings here are the Government House, Collector's and the Deputy Collectors' bungalows, the Post-office, and the Deputy Collector's bungalow at Kotree. The three first require but trifling repairs, which are now in progress. An estimate has been already sent in for repairs to the two last. The Post-office will however require still further repairs than that estimated for by me, as the rain has caused some damage to the out-houses.

3.—With reference to the latter portion of Mr. Frere's remarks I would suggest the advisability of crossing all nullahs where there is a direct communication or much traffic by pucka bridges; the present custom is a most dangerous one, and I have repeatedly heard complaints of such being their state without going out of military cantonments. I would mention the following across the nullah leading to the Fullalee by the N. W. postern:—

Do. do. do. to the 2nd Belooch lines by Shahmuckrar.

Do. do. do. by Dr. Laurence's house, lately occupied by Lieut. Grant.

Do. do. do. by the S. W. postern, being the direct road to Mohamed-Khan-ka-tanda.

Hyderabad, 23rd August, 1851.

I have &c.,
Signed F. WEMYSS, Captain,
Ex.-Engineer, C. S. Division.

True Copy. Signed WALTER SCOTT, Lieut.-Colonel,
Superintending Engineer, Scinde.

True Copy. H. B. ELLIS,
Assistant Commissioner in Scinde.

No. 706 of 1851.

General Department.

To Lieutenant Colonel W. SCOTT,
Superintending Engineer, Scinde, Kurrachee.

Sir,—I have the honor to acknowledge the receipt of a circular letter No. 1520, dated 5th inst., from the Commissioner in Scinde (forwarded under your endorsement No. 1078, dated 7th inst.) calling for a report on the damages sustained to the public buildings, in consequence of the late heavy rain. In reply, I would beg to state that such of the buildings as are constructed of stone and lime have not suffered in any way, while many of those built of mud have been injured to a considerable extent, but I believe that in almost every instance of damage having occurred, the cause is traceable to some defect in the roofing. It has long been known that the barracks occupied by Her Majesty's 64th Regiment would not stand a heavy fall of rain: but notwithstanding this

no measures have ever been taken for rendering them habitable, though the subject has been repeatedly noticed from this office.

2.—The pendalls on the heights, and the new European pendalls are temporary mud buildings; the former have suffered considerably, while the latter have not at all, scarcely.

3.—The pendalls occupied by the Native troops, are all built of mud; they leaked during the late rain, but no damage of consequence occurred, except to one of the 1st. Grenadier pendalls which fell down, and this again was occasioned in consequence of the roof being covered with chunam plaster. It was the only pendall so covered. All the others being of mud.

4.—Government-House has suffered more than any other building constructed of mud, and to put it in good order will cost a considerable sum of money, which might have been in a measure avoided had the estimate forwarded with this office letter No. 647, dated 8th August 1850, for rendering water-tight the roofs of the verandahs, been approved of.

5.—From what has come under my observation, connected with the effects on public buildings of the late rain, I beg to state that I see no reason for altering the opinion I have ever entertained regarding the manner in which buildings should be constructed at Kurrachee, viz., all buildings of importance or intended to be permanent should be built of stone and lime, while temporary buildings, and such as are of minor importance should be built with stone, and mud foundations and splinths and mud superstructure. A mud building requires its roof to be put on in a very careful manner, and when finished constant attention to it is necessary, for there is no saying how much damage may not occur to mud walls in a very short space of time, if many tiles happen to be broken when rain falls, and to obtain new tiles at such a period is often impossible, as the surface of the country becomes no more nor less than a large quicksand, and both man and beast move about with considerable difficulty attended with danger, and such will continue to be the case, until permanent roads, bridges, &c., have been constructed.

6.—There cannot be a doubt regarding the desirableness of retaining rain water by means of tanks, but I am not aware of any thing ever having been done with a view to getting tanks excavated. A small

annual outlay would in a very few years go far towards the construction of one or more tanks, which when considered sufficiently large, should be faced all round with masonry. There are two or three excellent places for tanks on convenient parts of camp, towards its eastern boundary.

Kurrachee,
Ex.-Engineer's office,
19th August, 1851.

I have &c.,
(Signed.) J. HILL, Captain,
Ex.-Engineer, L. S. D.

True Copy. (Signed) WALTER SCOTT, Lieut. Colonel,
Superintending Engineer, Scinde.

True Copy. H. B. ELLIS,
Assistant Commissioner.

Extract paras 2 *to* 13, *from a letter from the Acting Collector of Hyderabad, No.* 856, *of* 1851, *dated the* 31*st. December.*

2.—The Deputy Collector of Meerpoor reports that in his district the quantity of rain that fell varied in the different pergunnahs, from 12 to 20 inches. Its effect on the cultivation has been beneficial in some, whilst in others the crops have been damaged by it : the only contractors who are said to have suffered loss are those of the Meerpoor and Aly-Bhur-Sangra pergunnahs;—the former to the extent of twenty-seven Khurwars, fifteen cassas of grain, and twenty-four and half Rupees, and the latter of thirty-nine Khurwars. Besides the above, the crops in the pergunnah of Manajoonajanee suffered to the amount of three Khurwars, twenty-five cassas, and some damage was caused to the cultivation at Joodah, by a portion of the bank of the Meema Joodah canal giving way. But the produce of the Meema pergunnah this season, is expected to amount to double that of any preceding year. The health of the people has not suffered much, but fever prevailed after the rains in some parts of the districts,—eleven lives were lost by drowning. The damage to private property is estimated at 2,500 Rupees, and nearly five Khurwars of Government grain have been destroyed in the Ambar-khannas. The pergunnah Bungalows have also been damaged slightly;—communication was interrupted during the rains.

3.—In places where river-water is not procurable, water for drinking purposes is obtained from the small tanks which retain the rain-

water for a short time; when these have been exhausted from cutcha-wells.

4.—The Deputy Collector of Halla reports that in his district, the quantity of rain that fell varied in the different pergunnahs from 12 to 36 inches. Its effects on the cultivation have been more unfavorable than in the Meerpoor district;—the loss to the contractors is estimated as follows:—

Of the Khitta pergunnah, Rs. 641½.

Of the Muneeja, 50 Khurwars of grain, by the submersion of five villages.

Of the Kund Lukyhee, 115 and odd Khurwars, and 488 Rupees, by the bursting of three bunds.

Of the Jamwah, 53 Khurwars, which however they expect will be made up by the increased Rubbee crop.

Of the Shutwah, 22 Khurwars ditto ditto.

Of the Halla, 41 Khurwars, and 50 Rupees, by the submersion of land which will be good for Rubbee cultivation. Besides the above, some other slight damages have been caused by the rain, and the unusually high inundation; the health of the people too, has suffered from fever; sixteen lives were lost by drowning, and one man was killed by the fall of a wall;—the damage done to private property is estimated at 450 Rupees, and 25 Khurwars of grain besides the destruction of some houses. The pergunnah Bungalows have suffered more or less; that at Gumbut has had its roof entirely destroyed, and the Kardar's Dhera too has fallen down, and about 15 Khurwars of grain, Government property, have been damaged. Communication was interrupted during the rains; water for drinking purposes is procured from canals during the inundation, and from wells when it subsides. In some places are small tanks which retain the rain-water.

5.—The Deputy Collector of Mohamed-Khan-ka-tanda district, reports that the quantity of rain that fell varied in the different pergunnahs from 6 to 18 inches. Its effect on the cultivation has been generally speaking favorable, for although the Khurreef crops suffered serious injury by the submersion of a great portion of some pergunnahs in consequence of the high inundation, yet the quantity

of land rendered capable of Rubbee cultivation by the rain, is considerable, and the coming Rubbee harvest is therefore expected to be very abundant. The health of the people has not suffered beyond what the prevalence of fever in some parts may be supposed to have occasioned. Eleven lives were lost by drowning.—Communication was considerably interrupted between places during the rains. At Khuttar half a Khurwar of Government grain was damaged in the Ambarkhanna, and one side of the sluice at the mouth of the Khyrewah fell in, which it will cost 50 Rupees to repair. No loss of private property is known to have occurred, water for drinking purposes is procured from canals during the inundation, and from wells when it subsides.

6.—The Deputy Collector of Laikpoor and Shahbunder reports :—That in his district the cultivation until the end of June was progressing most favorably, and that there was every prospect of a most abundant harvest. That in July however from the great rise in the Indus, and from an almost unprecedented and continuous fall of rain, the whole line of bunds which protect the river Indus-face of the districts from the encroachments of the river, also the bunds on the sides of some of the principal canals, burst, and in many parts the country was entirely inundated. Out of the eighteen Tuppas in the districts, the following ; Kuskartya, Dadooke Choreea, Bunna Laikpoor, Meerpoor Buttora, Khuddee, Sherin, Birampoor, Seeranee, Gabahee, Amra, Shakapoor, Munyur Jutee, and Moradpoor suffered greatly from the bursting of these bunds. The rush of water over parts of these districts is described to have been as broad and rapid as the Indus itself, and consequently no immediate steps could be taken to repair the damage which increased day by day. In addition to this, the rain before alluded to began to fall, and the people were put to great distress. Some of the large towns such as Meerpoor Buttora, &c., and nearly all the smaller villages lying in exposed situations along the banks of the river, and large canals, were for a time deserted by their inhabitants, who fled to other parts of the country, lying above the reach of the flood. The other Tuppas not mentioned in the above list suffered, if not from the flood, at least a great deal from the effects of the heavy rains.

7.—From the Kardars and Ameen's reports, the following may be considered as the damage caused by the flood, and rain, to the cultivated parts of the country ;—the same too shows what may be expected from an access of the general average of the Rubbee cultivation.

Pergunnahs.	Area of land under cultivation of Khurreef 1262.	Area of land swamped by river or flood.	Estimated value of what the Government share of the injured crops under the old Butial system would have been.		Amount of Government Leases.	Cause of damage.	Area of Rubbee cultivation beyond the general average owing to the flood & rain.
	Beegas.	Beegas.	Rs.	A.	Rupees.		Beegas.
Kuskartya..	10,453	1,866	2,600	0	Rs. 13,000.	Bursting of bunds.	672
Dundee Kokur.. ...	15,125	1,356	851	0	Rs. 1851-12, and khurwars 825,30 cassas.	Rain.	140
Dadookee Choreea.	5,793	1,708	2,056	8	Rs. 5,446, and 60 khurwars.	Bursting of bunds near Choreea.	675
Bruma Laikpoor....	13,583	10,450	12,427	0	Rs. 11,231, and 374 khurwars.	Bursting of bunds near Bunna.	4,330
Keeral Kote Alma .	11,903	2,644	1,777	8	Rs. 234½, and 541½ khurwars.	Bursting of bunds in Kote Alma.	1,150
Dutchur Walleesha.	13,424	6,020	4,960	0	Rs. 2439 cash and 586 khurwars.	Bursting in the Pergh. & Pinyaree.	2,787
Meerpoor Buttora...	37,325	29,267	27,000	0	Rs. 4,876¾ cash, and 1879 khurwars.	Bursting of bunds on Pinyaree and also Bunna, &c.	4,235
Amra Shakapoor....	7,079	7,001	9,160	0	Rs. 12&37 khurwars, 30 cassas.	Ditto ditto.	2,880
Manyur....	41,726	23,577	15,309	8	Rs. 594 and 1,894 khurwars.	Ditto ditto, and rain.	12,558
Korewal....	2,440	555	366	10	Rs. 24-2-8, and 372 khurwars, 1 cassa.	Rain.	1
Gabahee....	5,004	2,565	3,280	0	Rs. 4,055-4 cash, 264 khurwars, 4 cassas.	Bursting of bunds in Bunna.	800
Birampoor Seeram.	6,291	3,504	2,342	3	Rs. 8,110-6-10, & 98 khurwars, 13 cassas.	Bursting of bunds in Bunna, and rain.	2,004
Suttaha and Cheja..	27,334	2,306	2,250	0	Rs. 1,276 cash, and 1,086 khurwars.	Bursting of bunds in Cheja, & Sherin Pergunnah.	1,730
Jatee.....	18,894	17,681	20,600	0	Rs. 36,000.	Rain & flood from the Pinyaree & Pergh. Bunna.	2,700
Sherin....	2,080	7,981	11,450	0	Rs. 1,636 cash, and 1,233 khurwars.	Rain and bursting of Pergunnah bund.	1,954
Shore.....	26,703	2,773	2,052	0	Rs. 42,000.	Flood from river.	....
Dook Gudga*.....	6,190	1,753	1,889	0	Rs. 3,538 cash, & 423 khurwars.	Rain.	341
Kuddee†...	5,783	2,689	5,000	0	Rs. 1,956 cash, & 388 khurwars.	Bursting of bunds near Kuddee.	800

* No bunds burst in Tappa Shore.

† The great rise of the river alone caused damage.

8.—Fever throughout these districts is usually prevalent after the inundation, but this season in consequence of so many of the pergunnahs having been swamped, it was peculiarly so. And from August till the beginning of December, it was most severe; it does not however, appear that there the mortality much increased from its effects—arising from the fever, being of an intermittent nature.

9.—It does not appear that any loss of life was occasioned by the flood itself. Several instances of deaths occurred from exposure to the wet, and the verdict of the Courts of Inquest was always in such cases, "Died from exposure."

10.—With regard to the loss of public property, the various pergunnah bungalows have sustained more or less damage from the rain. The Government has sustained no loss from damage to grain in store —the Kardars being wholly responsible for the same.

11.—Private property has suffered greatly, and in the Bunna Meerpoor pergunnahs, ninety-eight hamlets were destroyed or rendered uninhabitable by the flood. The construction of these forms a mere nominal loss, as the reconstruction of the mud-houses in which the poorer classes live involve only labour, but no actual pecuniary expenses, the wood-work still remaining where the huts fell. The people are now returning to their homes, a few cattle only were lost, but large numbers of sheep and goats were drowned;—the property of the inhabitants being mostly of a portable nature was, generally speaking, saved.

12.—During the continuance of the inundation the country was impassable save by boats, all communication by land being stopped. Generally speaking, the roads are good, and equal to the present requirements of the country.

13.—It does not appear that the inhabitants have taken advantage of the late heavy fall of rain, to provide themselves with a future supply of drinking water. In some places wells exist, and along the river line good water is always abundant, as also in the beds of the large off-lets—the Goongea, Pinyaree, &c., but, indeed, the supply of water is in many places both insufficient and bad in quality. In many places, the only supply during this season is from a pit near the village, probably from which the earth used in building the houses was dug, and which is filled from season to season by some canal. Good wells in small villages are scarce, both on account of the expense entailed, and

also, in some places, from its being found that the water (if the su soil even around be salt) often becomes brackish. However, as a ge rule, no better use can be found for the 1,000 Rupees, annually all for public works than by digging wells with the amount. They indeed be found a great boon to the community.

True Extract. H. B. ELLIS,
Commissioner in Scin

Extract paras 2 to 11, inclusive, from a letter from Ca Partridge, Deputy Collector of Ghorabharree, No. 181, 3rd October, 1851.

2.—The Kardar of Ghorabharree reports that in consequen the late rain which, on the low lands of this district, almost stituted it one vast lake, the people, from cold and other concomi in such state of constant dampness, suffered much in health, a number of inhabitants also have been obliged to change residence to such spots as a great degree of comfort provide The rain in this Pergunnah lasted, with little intermission, fro 3rd July to 17th August, but no loss of life occurred, save man,—about two fifths of our rice cultivation has been destr and the Bungalow and Kardar's office and Jail, almost totally rui the loss of the Banyans and traders was very extensive, as inundation entered, notwithstanding every effort to prevent i houses and shops in the town, and remained there for some day Banyans and inhabitants having been put to an expense of Rupees 450 for constructing Bunds, out of which Rupees 20 been allowed them by Government;—the loss sustained by the p class of ryots as estimated at about Rupees 400.

3.—The roads and communications between villages are sa have been very much cut up, and a good number of fruit tree troyed; the embankments are all in ruins save those of Alle Deh Bukshah and Jungasur.

4.—The tanks of Kuleefa, Soomra, and Jungasur are filled suffic ly to afford water to the people, till the inundation of next

5.—It is expected that by the rise in the price consequent o

late destruction of crops, the Banyans may be able to realize some portion of their losses in damaged grain.

6.—The Kardar of Syatree reports that in general the people have suffered a good deal from the colds, coughs, and fevers incident to the very extraordinary season they have experienced ;—the rain fell in this district from the 6th July to 2nd August, almost without intermission, but no loss of life occurred, the benefit accruing to Government from the excessive rain consists in much of the highlands not usually submerged having been rendered fit by flooding for Rubbee Crops, now under cultivation. The loss to Government has been principally in buildings. The two Bungalows at Bemunka-Poora and Moochara, although requiring much repairs previously, are in ruins, and not habitable ; the Kardars' offices at Beemunka-Poora, Thyme, Boharra and Moochara, the three first of which had been previously repaired, are also level with the ground. The ryots have sustained such loss as the falling of their habitations has occasioned, nearly all the grain in their houses stored for their own consumption being lost, as well as all their rice or Sylabee crops, their Sugar Cane cultivation is likewise injured ; the redeeming benefit to the Ryots is the greater quantity of Rubbee land ready to their hand for the plough, and the ample enjoyment of green fodder for their cattle, whereby one of their most common necessaries of life (milk) has been materially increased ;—the Lownee and Muknee grasses have also afforded the seeds, which amongst the poorer classes form part of their subsistence.

7.—The roads in this district do not seem to have been more injured than usual, but communication between the different villages was at the height of the flood nearly stopped,—the fruit trees may have sustained injury, but it is not yet sufficiently apparent. The tanks of Mooya and Syatree have sufficient water in them to last until the next inundation, which has not been hitherto usual in ordinary seasons.

8.—The Sakra Kardar reports that the people generally felt the usual effect of such a wet season in colds, &c.; the rain lasted from the 7th July till the 2nd August, but no lives were lost, the extent of benefit to Government consists in the flooding of four villages which were not put in contract, in consequence of the want of water rendering them waste. Rubbee crops are now being sown on them, this of course also

benefits the Ryots, but the low land cultivation, such as rice and some of the wheats have been much injured, whilst other have benefited ; the Sugar Cane cultivation has received no injury.

9.—The people have sustained considerable loss, not so much by the falling of the houses as by the destruction of the grain they had stored up in them, for the next six or eight month's consumption.

10.—The roads in this district have been much injured, and the tanks of Chuch Wurriarki, Chuch Meerakhar, Tullah, and Trakanee are filled with water sufficient for consumption until next year.

11.—In all the pergunnahs there seems to have been a good deal of distress amongst the laboring classes, at the time the incessant rain prevented them working for their subsistence, and with the improvidence generally of the Scindian character, it can easily be understood.

True Extract. H. B. ELLIS,
Commissioner in Scinde.

Extract paras 2 to 26, from a letter from the Deputy Collector of Sehwan, No. 327, dated the 3rd October, 1851.

2.—There being no Pluviometer at Sehwan, no register of the fall of rain could be kept, but the daily accounts agreed so closely with the rain at Kotree that the amount registered in the latter place, viz : a fraction under eleven inches, may be taken as a near approximation.

3.—But besides the rain falling from above, the Sehwan district receives from the west the waters from the Gaj, and all the hill-streams, which drain the eastern face of the range of hills lying along the western boundary of the zillah; on the east the river overflows its banks, and finds its way by natural channels to the low lands, while in the centre the Narra empties itself into the Munchar. The Arul also runs into the Munchar until the water from it, the Narrahs, and the Arul together, raise the water above the level of the Indus at Sehwan, after which the Arul acts as a drain.

4.—With water pouring into the Munchar from all these sources, and at a time when a large part of the Rubbee grain was lying exposed in the Buttai enclosures, and the Khurreef crops were still young, it was to be expected that much injury would result to the grain in the Buttai enclosures, and to the green crops standing in low ground.

5.—In the neighbourhood of several Kurrahs, the water from the hills came down so suddenly that the water got into the enclosures, and washed some of the grain away before it could be removed to higher ground, and in the low lands about the Munchar, the grain was obliged to be put into boats and spread out on any dry piece of land that could be found,—much loss and waste occurring in so doing.

6.—The total loss in the Khurrahs is estimated at 1,017 khurwars by the Kardars, being about khurwars 339 of Government property, and khurwars 678 of the cultivators'.

7.—The Kardar of Boobuk reports 26 khurwars, and the Kardar of Samtannee 60 khurwars of grain to have been destroyed in their respective granaries. This can only be ascertained when the granaries are finally cleared, but I cannot anticipate that much of the grain in store will be found in a damaged condition.

8.—The injury done to the standing crops will probably be more than compensated by the good supply of water to the higher grounds, and though the cultivators would lose their seed and labor, many of them would be able to raise another Khurreef crop on the high lands where laborers were scarce.

9.—The district bungalow at Amree is the only public building that appears to have suffered much from the rain. The Sehwan bungalow is of burnt brick, and will not require more than the usual annual repairs.

10.—I have no return of the amount of loss of private houses, but from the reports received, and judging from the effects of the rain on similarly constructed houses at Kotree, I believe the pecuniary loss has been very trifling, though the discomfort and inconvenience to which the residents were put during the rain must have been very great.

11.—Whole villages were obliged to be deserted, but this happens during very high inundation, and is not looked upon as any great hardship by the Mussulmen population, whose mat-huts are easily carried away and erected on other spots.

12.—During the rain two women were killed by the falling of their house in Sehwan; one man in Boobuk, and one woman in Samtannee were killed by the falling of walls near which they were at work. Two men were struck by lightning in Samtannee, one of whom died. Three men were suddenly overtaken by the water in the bed of a hill-stream

called the Mugunnee Nye, one succeeded in making his escape, and the other two were drowned; one woman was drowned by the upsetting of a boat in which she and her family were escaping from their submerged village.

13.—These are the only cases of loss of life directly attributable to the late storms and rain. A lamentable number of children are drowned every year from being allowed to play about the banks of the rivers, and canals, while their mothers are away at work, and the higher the inundation the greater the number of deaths from this cause.

14.—The effect of the rain on the general health of the population cannot yet be ascertained as the season of fever is only commencing, but I should anticipate that more benefit will accrue from the abundant harvest and plentiful supply of food (both fish and grain) to the health of a people accustomed to live almost in the water, than injury from any unusual prevalence of fever. Some sickness may perhaps be caused by the use of damaged grain before the Khurreef crops ripen.

15.—Cholera prevails in the districts at present, but cannot be attributed to the rain. It has followed the same upward course as it did in the atumn of 1846, when there was no rain.

16.—Communication in the Sehwan districts during the hot weather is principally carried on in boats, except in the higher tracts west of the Munchar lake. In this, the roads were impassable so long as the hill-streams continued to flow.

17.—Referring to that portion of the letter under reply calling for any practical suggestions arising out of the experience of the past season, I would observe that the principal injury has occurred to the gathered grain and to the crops. The first object therefore is the preservation of these.

18.—The grain most injured was that lying in the Buttai enclosures for division between the Government and the cultivators. The Rubbee crops are cut in April, and those not assessed in Buttai had been housed long before the rain commenced. As Buttaidars and their establishments would not be remunerated for their trouble in Buttaying smaller divisions than are now made, great delay must always occur in the removal of Buttaied grain, and the only remedy is the abolishment of the system altogether.

19.—It would not be worth while to build any expensive granaries to

store grain in, and until grain payments can be commuted into cash; an earlier disposal of Government grain will be the best way of avoiding losses by the wetting of stored grain.

20.—Khurreef crops grown in low lands are always liable to be flooded, but these lands then yield a Rubbee crop, and the Khurreef extends over the higher ground; generally speaking, it would be disadvantageous to attempt to keep out the water by Bunds.

21.—The injury to buildings as before remarked does not appear to have been great, and the mud buildings well-plastered and in good repair that came under my own observation seemed to stand the rain well.

22.—The natives in upper Scinde say that until about thirty or forty years ago rain fell pretty regularly every hot weather, and there is abundant evidence in the remains of old Bunds, and the marks of cultivation along the western frontier, that the river streams at one time afforded a much larger supply of water than they have done of late. There is a tradition, I have heard repeated by the natives, that there have been series of dry years and series of raining years extending over periods of 40 or 50 years, and it is possible we may now be entering on one of the latter.

23.—But even supposing the rain should fall, as frequently as it is said to have done before, mud and plaster buildings, appear to have always been sufficient, and there is no good reason for resorting to the use of burnt bricks and mortar for building houses, which unless very large and expensive would be too hot to live in.

24.—To keep mud and bhoossa buildings however in a good state, it is necessary that repairs should be executed at once, and every crack or hole in the bhoossa plastering filled up before rain has a chance to get inside the walls, and the Kardars or other officers on the spot should have authority to execute such petty repairs without the present references, and delays, pending which serious injury may occur to the buildings.

25.—The question of roads in Sehwan is one of some difficulty. The fertility of the district is dependant on the free access the water has to all parts. A raised road, east of the Munchar, would act as a Bund, and throw a good deal of land out of cultivation unless expensive bridges and viaducts were made over the course of the present inundation. To

tell to what extent this would be practicable requires more knowledge of the locality and the water channels than I possess at present.

26.—Should a road be cleared through the hills to Sehwan, it is possible a good line might be found west of the Munchar, starting from the Sehwan road at Peraree and keeping to the west of the river-water cultivation, and joining the Larkhana road at Nusseerabad. This route would be circuitous but free from inundation, and only liable to interruption when the hill-streams were actually running into the Narrah and Munchar, which they will seldom do if the bunds in Kacha are kept in good order.

True Extract. H. B. ELLIS,
Assistant Commissioner in Scinde.

Extract of Digest of Intelligence from the Deputy Collector of Jurruck, dated 25th October, 1851.

2.—The damage occasioned to the cultivation by the floods in the pergunnahs of the Town of Jurruck has been ascertained,—3,335 beegahs of Sylabee cultivation with two Hoorlas have been lost, containing thirty-two Khurwars and five Cassas of seed. The Jaghiredar of Jurruck has suffered nearly to an equal amount.

Note by the Collector.
The whole of the lands submerged, with the exception of the 2nd Hoorlas (about 15 or 20 Beegahs), paid rent on the Buttai system.

True Extract. H. B. ELLIS,
Assistant Commissioner.

Extract paras 2 to 8, inclusive, from a letter from the Deputy Collector of Jurruck, No. 205, dated the 8th October, 1851.

2.—It is said by the natives that during the times of the Ameers, the country used to be visited with periodical rain, a circumstance which appears probable from the dry beds of tanks and hill-streams which occasionally present themselves; the recent fall however is said by them to exceed by two-thirds any which they remember to have experienced, preceded as it has been by a comparative drought of several years' duration, it is rendered so much the more remarkable, and through its having been seconded by an unusal rise of the Indus, a surface of water has been spread over the face of the country such as never has been known to the present generation.

3.—At the period of its commencement, the harvest of the Rubbee crops in the lower districts had been fortunately completed, and the grain garnered, but in the upper, where the season is much later, a great part of the grain was in the field store-yards whence much injury resulted, amounting to nearly a fourth of the produce. Much of the seed for the ensuing Khurreef cultivation has been sown ere this, but it was soon washed away, replaced and again destroyed so that as late as the 5th of September the people were reported to be still ploughing and sowing in places where it was practicable. The rice crops and fields of Cotton and Indigo were swamped entirely. The features of the cultivation underwent an entire revolution, for so much of it as could be raised was with a few local exceptions effected spontaneously, without the aid of wheels. It would be imagined that the latter would prove to be rich and full, but on the contrary, the moisture appears to have been too great for them, for though the stalks are tall and luxuriant yet there is a complaint of their possessing little ear. The combined effect of the rain and flood has been altogether most disastrous to the Khurreef cultivation, the greater part of which is destroyed, but on the other hand there are advantages such as have never been before presented for a favourable Rubbee season, which I hope will counterbalance every loss. A great extent of land which was saturated is now available, and there is much contention among the Zemindars for such portions as have been for many years lying useless. The rain has been of great benefit to the hilly country on my western frontier, which for the last three or four years has suffered from drought, so that the different tribes, frequenting the same were obliged to disperse into the plains, where they used to occasion much annoyance by their thieving propensities; they have now returned to the Hills, where they are actively employed in cultivating, but at the very commencement their crops were twice swept away. The Verow Bund, which has been totally dry for the last three years, so much so that even drinking water was not procurable, presents now a surface of water about four square miles, thereby giving employment to a great number of idle people, who possessed at best but precarious and doubtful means of subsistence; not only these, but, I may add, the whole of the cultivators are begging for Tuccavee or advances of seed, with the view of enabling them to

push their cultivation to the utmost. The rain has been most beneficial also in filling the tanks and wells. Kinjur and Jhol lakes which have been dry for years are filled to overflowing, and the quantity of grass produced is a great relief to the cattle, which have at times suffered latterly much privation.

4.—The towns and villages built as they are of mud, and in no way adapted for such a contingency, have suffered severely. The Government Bungalow at Gharra fell, and the town was well nigh swamped; the road and the greater part of the country between this and Tatta was submerged. At Tatta 300 houses fell, and the whole town was more or less injured. The exertions of the inhabitants saved a considerable portion of it from being altogether washed away, for the water could not find an outlet, and accumulated in an alarming quantity:—about 500 houses fell in the different villages of the district around it. The merchants suffered much loss in their granaries, but I have not heard of any remarkable loss in other respects.

5.—In the Seree district the Lallung Bunnas were carried away, and the Mookans of Lallung, Dufferance, Tara Ameedanee and Baroch were swamped; the people were obliged to take refuge in the hills, and a great number of goats were swept away. Further north, the whole country between Jurruck and the Barun river, a distance of about fourteen miles was a sheet of water, all the villages sustained more or less injury while the encampments and cultivation were all destroyed. The town of Kotree appears to have suffered comparatively little, and indeed from what I can ascertain the rain was far less, nor have I heard of any particular loss of property at that place. The towns of Mahajunda and Noorpore were in great danger of being destroyed, as the rain water which came down from the hills were confined by the embankments on the margin of the river, and collected in large quantities These embankments gave away, and extensive repairs to them will be necessary in consequence.

6.—The extraordinary season was preceded by a period of distressingly hot weather, such as I have never before experienced in Scinde. An arid wind, accompanied by a depressing feeling in the atmosphere, created a good deal of sickness; the cholera appeared in a virulent form, and it was such weather altogether that people could not be persuaded to leave their houses. The rain was therefore very beneficial for the

time, but its subsequent evaporation has necessarily created much fever, and though it is not nearly so bad as I expected yet there is some reason to apprehend that the most of it is to come.

7.—As I was absent myself from my duties through sickness at this period, I am unable to speak so fully as I would have wished regarding the interruption to communication which occurred through the rain. The post was conveyed with much difficulty, and I understand chiefly by a route at the foot of the hills, and boats were employed for its transmission at two or three of the swamped localities. The communication in the district near Tatta seems to have been impeded more particularly. So much of the new road which has been made is at the time of my writing this still for a great part under water, so that I cannot yet say what damage it has suffered. A portion of the line near Gharra is now being proceeded with as there is none other accessible.

8.—On the north of Tatta, there is a portion of road between Chatta and Chillya-ke-Gaum, which passes through a very low country, where even in ordinary seasons considerable difficulty is experienced, and I would beg to recommend, if it were practicable, that a raised road should be constructed over it. The entire length is about four miles, part of which was traversed after the late rain in a boat. There is another very awkward place half way between Jurruck and Kotree, where the Barun (a hill-stream) falls into the Indus. The road traverses the mouth of it, which is about half a mile broad and very sandy; at the period of the inundation this is always more or less submerged, whereby the post is obliged to go a round of two or three miles. An embankment across it would not be feasible, as it would always be liable to be swept away by a fresh stream from the hills; a boat worked upon a rope, extended from bank to bank (such as I have seen in the Deccan), appears to me the cheapest expedient, that could be adopted, for the strength of the stream would render any common ferry boat, worked in the usual manner, of no use. I would not recommend the construction of any tanks because with the exception of Tatta, all the important towns and villages are within the reach of the Indus. The above town is at a distance of five miles, which is too far for the natives to supply themselves, and they have hitherto contented themselves with drinking fœtid water procured from pits sunk in the mud, to which circumstance I attribute much of the sickness which is always to be found there. I

am about to supply the deficiency by building a large well out of the funds lately granted by government for works of public utility, and which to the best of my judgment would be far preferable to a tank.

H. B. ELLIS, Assistant Commissioner in Scinde.

ART. VI.—*A report of the disastrous consequences of the severe earthquake felt on the frontier of Upper Scinde on the 24th January,* 1852.

To the Right Hon'ble Lord VISCOUNT FALKLAND, 16th Feb., 1852.

MY LORD,— I have the honor to enclose copy of a letter from Major John Jacob, C. B., Commanding Scinde Horse, and Political Superintendent of the Frontier, with copy of one from Lieut. Merewether giving a very interesting account of a very severe earthquake, which on the night of the 24th January destroyed Kahun, the chief town of the Murrees.

2.—Lieutenant Merewether had previously reported to Major John Jacob, that the shock was felt at Khanghur at 3h. 45m. A. M. The direction was East and West, and the day succeeding it was cloudy. The people of Kutchee stated that earthquakes occurred every three or four years in the Murree hills,—the last having been during the last Punjaub war.

3.—It may be of interest to add the following list of earthquakes, which I have noted as having been felt in this and the neighbouring provinces, during the past year.

17*th January,* 1851.—A slight shock felt at many places in the Punjaub.

2*nd February,* 1851.—At Phooljee, near Sehwan.

4*th February,* 1851.—At Lahore and Wuzeerabad.

19*th April,* 1851.—At 5 P. M., three shocks felt at Gwadir in Mekran, —several houses destroyed.

22*nd* and 27*th April,* 1851.—Earthquakes felt at Oothul and Syaree in Sup-Beila.

BELOOCHISTAN.—13*th. December,* 1851.—At Shapoore in Cutchee, at the foot of the Murree hills. 24*th January,* 1852.—That at Kahun above described.

Khanghur, 9th February, 1852.

SIR,—Under instructions received from you yesterday, I have the honor to report for your information, the undermentioned circumstances

connected with an earthquake that occurred on this Frontier lately, and which has been attended with most fatal results to the Murree tribe. On the morning of the 24th ultimo at 3h. 45m., a slight shock was felt here, but not sufficient to affect in any way the buildings in this neighbourhood. After some days had elapsed, intelligence was received that the same had been felt in other parts of the country to the Northward to a less or greater degree, but especially in the Murree hills where it had been the cause of the death of a large number of people, and of the loss of much cattle and other property. It was some time before fully authentic particulars were received, of which the following is an abstract. On the morning of the 2nd day of the Mussulman month Rubbee-ul-Akbir (corresponding to the 24th of January of our reckoning), at the time of the appearance of the false dawn, that is about 4 o'clock, a very severe shock of an earthquake was felt at Kahun, the principal Fort in the Murree hills and residence of the chief and main portion of that tribe;—one side of the Fort-wall was thrown down, the remainder much shattered, and the greater number of the houses inside also overthrown, burying beneath the ruins many men, women, and children, with some cattle, and a good deal of property besides. Deen Mahomed the chief of the tribe himself appears to have had a miraculous escape, the house in which he was living falling with the others and men being killed on either side of him; he was saved by the portion of the house immediately above him remaining firm until the motion had ceased, when he was found hemmed in by the ruins of the remainder of his dwelling;—most of the private houses, Bunniahs' shops, &c., within the Fort either fell to the ground or were so shaken, that it was considered unsafe to remain longer within them. On this Deen Mahomed, his family, and all the usual residents within Kahun left it, and proceeded to another small Fort called Dost Ali's (the uncle of the chief) Kotela, not far distant; entirely abandoning a place which they looked upon with superstitious dread, as unlucky and pregnant with further misfortune to them, did they remain there longer; and, I believe, owing to the strong feeling these people have on these subjects, that it will never again be inhabited by them. At the same time that this disaster occurred at Kahun another even more fearful calamity overtook a portion of the tribe, living with their cattle in a large cave, some little distance to the

Northward. The hill, in which the cave was, was violently shaken, and fell burying nearly every living being at that time within it. The road by Nuffoosk to Kahun has been completely closed by the hill falling, and filling up the pass through which it formerly went. A considerable increase to the flow of water in the Lahree river has taken place; so much so that water is now flowing past where it never even came to before, excepting after heavy rain. According to the last accounts received, 260, Mussalmen, women and children, have been killed, and upwards of eighty Hindoos, with a large quantity of cattle; the amount of the latter yet unkown. As far as I can learn any disastrous effects from this earthquake have been confined to the Murree hills, and the consequent effect on the minds of these wild people, highly superstitious, is very great.

Their chiefs were assembled to proceed to Gundava to make their submission to H. H. the Khan of Kelat, and had, indeed, advanced some distance for that purpose, when hearing of this severe affliction they returned to learn the loss they had sustained. They now declare that they will abandon the hills to which a curse seems attached, and apply to the Khan of Kelat for permission to reside in the plains in the neighbourhood of Gundava, Dadur, or Lahree. The reports as to whether any persons of note in the tribe are among the killed are very vague, but a son of Gonim Khan (cousin to Deen Mahomed), is mentioned, and an influential Syud of the name of Lall Shah. The earthquake appears to have been felt throughout Cutchee; at Gundava, Dadur, Bhagh, Lahree, Pooljee, Chuttur, &c., at the same time as it was at Khanghur, and at Kahun about 4 o'clock on the morning of the 24th ultimo. A resident of Chuttur, who was fully awake at the time the earthquake took place, declares there were three perfectly distinct shocks perceptible, a few seconds intervening between each.

Curiously, no mention has yet been made to me of its being at all felt any where to the South, neither have any accounts been received from Kelat or Western Beeloochistan of its having been the cause of injury to any of the large cities in those hills.

I have &c.,

W. MEREWETHER, Lieut., Commanding Frontier of U. S.

ART. VII.—*Remarks on the Laterite of the Southern Conkan and Southern Mahratta Country.* By Captain G. WINGATE, of the Engineers. (Received July 15.)

THE late Captain Newbold, in his Geological Notes on the Southern Mahratta Country, published in the Journal of the Asiatic Society of Bengal for 1845, No. CLX., classed the laterite as a sedimentary rock*; but my observation of it in the same locality, and in the Southern Conkan, where the formation is most extensively developed, leads me to question the accuracy of his conclusion, and to incline rather to the view of those geologists who consider the laterite to be the result of the weathering of other rocks *in-situ*. I venture to offer the following observations on this subject, in the hope that they may throw light on the still contested question as to the origin of this singular rock.

In the Southern Conkan the most extensive and thickest beds of laterite are found along the coast, where cliffs of this rock may be observed of fifty feet and upwards in height. The laterite occasionally covers the entire surface of the country for several miles inland, forming elevated sterile plateaus, which are intersected by deep narrow valleys and rugged ravines, through which the rivers and streams find their way to the sea. Further from the coast, the thickness of the laterite rapidly diminishes to a thin stratum or sheet overlying the subjacent rocks, and in the neighbourhood of the Ghauts this laterite mantle is frequently altogether wanting. Above the Ghauts, the higher ranges are generally capped with laterite for ten to twenty miles inland, but beyond this the rock is rarely met with, unless in detached patches of limited extent, as at Belgaon, Dharwar, and other places within forty to fifty miles of the Ghauts. Still further inland, Captain Newbold found a lateritic conglomerate in the neighbourhood of Kulladghee, and he also mentions it as capping some of the sandstone hills of the Seetadonga range near Bagulkhote, but these examples of the rock are of limited extent. The laterite formation then, in the localities I have mentioned, is most amply developed in the immediate neighbourhood of the sea, and is nearly limited to a belt of country not exceeding 100 miles in width, and following the direction of the coast line.

It is worthy of note that this belt is also the region of long-con-

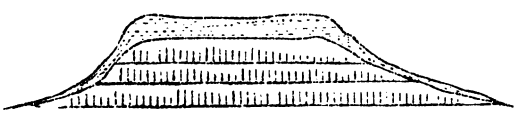
* See Captain Newbold's account of Laterite—Appendix D. to the Geology of Bombay, *ante* page 231.—EDITOR.

tinued heavy Monsoon rain. The heat and humidity of the climate occasion a rapid decomposition of the surface rocks, and when these happen to be impregnated with iron, they appear to me to be gradually changed into laterite. The laterite then, according to this view, is neither a sedimentary nor an igneous rock, but a metamorphosed rock formed by the action of heat, moisture, and other existing causes. The greater thickness of the laterite formation in the immediate vicinity of the Sea, points also to the conclusion that the salt spray driven up over the land by the strong winds prevailing in the Monsoon, is an important agency in the metamorphosing process. It further results from the hypothesis, that laterite is a recent rock, and is probably even now in process of formation.

The facts on which these conclusions rest, are the following. The cavities of the laterite, unlike those of igneous rocks occasioned by imprisoned gases, form continuous intermingling channels, through which water escapes freely, and this circumstance accounts for the Conkan villages built upon the laterite remaining clean and dry in the heaviest rain, as well as for their comparative healthiness. The cavities in question have invariably a downward direction, and seem to have been formed by the percolation of water through the rock. The metallic glaze of the interior coating of these cavities is probably formed of substances held in solution by the percolating water, and a similar coating may be observed in the cavities of a concretionary pseudo-laterite, formed of an agglutinated ferruginous gravel, which is found in the dry beds of nullahs in the Deccan, and other localities, occasionally overflowed by running water. The true laterite I consider to be a rock decomposed and changed *in-situ*. I have observed unequivocal examples of various kinds of trap, sandstone, grit, and metamorphic schist, converted into laterite. The latter in each of these instances, exhibits peculiarities according to the nature of the rock from which it has been formed, and under favorable conditions the conversion has been effected without disturbance of the strata or beds of the original rock.

Trap-laterite is formed extensively in the Southern Conkan, and a beautiful example of it may be seen in the Fort of Viziadroog. The entire hill on which the fort is built is a mass of laterite, and the scarped sides of the ditches in several parts exhibit the horizontal super-

position of the original trap beds, and also in some places their obscurely prismatic structure, so perfectly that where blackened by the weather the rock might readily be mistaken for basalt. The original structure of the trap is quite perfect notwithstanding the conversion of the rock into the ordinary channelled red and yellow laterite. The flatness of the lateritic plateaus of the Southern Conkan, I ascribe to the horizontality of the trap beds from which they have been formed, and the latter rock may still be seen in many places. But the exposed edges of these trap beds, on the slopes of hills are often also found converted into laterite, which is then spread like a sheet or mantle over the subjacent trap beds, and may entirely conceal them from view, as in the marginal section, where the laterite covers the slopes as



well as the summit of the hill. The laterite of the slopes is generally found to have run into an amorphous sheet, so as to obscure all trace of the underlying strata. Unless in the immediate neighbourhood of the coast, however, the subjacent rock is usually discoverable in the beds of torrents which have either removed the laterite, or have prevented its formation in the first instance. The harder kinds of trap containing much iron, form a heavy ferruginous laterite; and again, the more aluminous and tufaceous varieties become a light description of laterite, frequently with the yellow color perdominating over the red. The most convincing proof of the conversion for which I am arguing is to be found where it is only partially effected. An attentive examination of almost any locality ten miles removed from the coast where the subjacent rocks are discoverable, will afford examples of this. I will instance one in a nullah immediately south of the village of Palee, about ten miles N. E. of Rutnagherrie, where a nodular trap has the outer concentric coats of its enclosed nodules converted into laterite, while the harder centres remain unchanged. A similar example occurs between the villages of Karrowtch and Yelloura on the road from Rajapoor to Lanjé. And all over the Southern Conkan, most of the detached fragments, and exposed surfaces of trap and other rocks, will be found more or less pitted or dotted over with small holes or cavities, which appear to indicate the commencement of the decomposing process by which the rock is converted into laterite.

The hard sandstone of Malwan and the neighbourhood of the Phonda Ghaut, will be found equally converted into laterite, as the more decomposable traps; but the character of the resulting formation is different. It is heavy and gritty, instead of being earthy like the trap-laterite,—being in fact full of grains of undecomposed quartz; but its sinuous cavities and red color are much the same. Above the Ghauts trap-laterite and metamorphic schist-laterite are common, the latter generally hard and heavy, with a large proportion of iron; and syenite-laterite is, if I mistake not, to be met with at Vingorla. Many examples of trap passing into laterite may be found among the stones lying about the travellers' bungalow at the top of the Phoonda Ghaut, and a geologist proceeding from Viziadroog by this route to Belgaon and Dharwar, would have an opportunity of seeing most of the varieties of laterite I have mentioned, without having occasion to leave the high road for more than fifty yards in the whole distance.

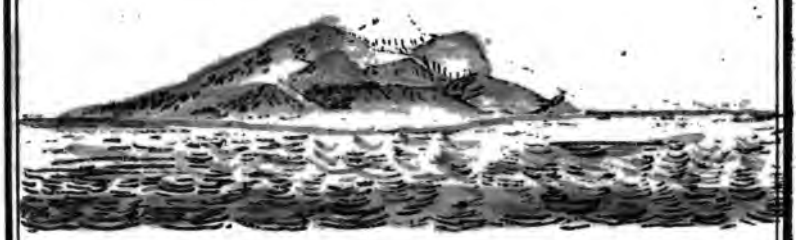
The decomposition by which I suppose the transformation into laterite to be effected, does not appear always to proceed in the same way. I have met with several specimens of trap converted into homogeneous yellow earth, without any indication of sinuous cavities. Again, the cavities appear in other instances first, as in the pitting of the surfaces of hard and soft traps and sandstones already noticed as so common. I have further found on breaking some hard trap nodules of a granular texture, and which externally appeared perfectly sound, that the fractured surface was dotted over with small white specks, which in some instances were enlarged into small cellular cavities filled with a brownish or yellowish earth, which as the process of decay goes on, may be easily supposed to become receptacles for water, and gradually to join each other until they become enlarged into the sinuous cavities characteristic of the laterite.

I conclude by recapitulating the chief facts that occur to me in favor of the hypothesis of the laterite being a rock transformed *in-situ* by the action of causes still in operation. These are—1st, the invariable superficiality of the rock. 2nd, The ordinary limitation of its occurrence to regions subject to heavy and long continued rains, by which the superficial rocks are rapidly decomposed, especially in the immediate

neighbourhood of the sea. 3rd, The vertical direction of the sinuous cavities which perforate the laterite from top to bottom, and form drainage channels for conveying down the rain falling on the surface of the rock. 4th, The frequent occurrence of rocks of different kinds partially transformed into laterite in the localities above mentioned. 5th, The fact of a kind of laterite with sinuous cavities similar to those of the true laterite, being found occasionally in the dry climate of the interior, in localities exposed to the action of running water. 6th, The circumstance of laterite presenting distinctive peculiarities according to the nature of the subjacent rock with which it is in contact, and from which it has apparently been formed.

But even if it should appear that these facts do not warrant the adoption of the hypothesis of the laterite being formed by the action of causes still in operation, they seem at least adequate to establish the theory of the laterite being the result of changes effected in other rocks *in-situ*, without reference to the period when the transformation occurred, and to be quite irreconcilable with the supposition of its being a sedimentary or an igneous rock.

NOTE.—What does Captain Wingate make of the fact of laterite being found near Quilon, separated from the rock below by a thick bed of lignite, with masses of mineral resin,—the rock next under it being a recent shale limestone? See ante, pp. 234-35.—EDITOR.



Volcano of Gibbel-Teer, Red Sea, about 500 feet high: still active,—the northernmost of the Red Sea Group[1]

Mud Volcano—one of the koops of Chundra—near Beila, Beloochistan.

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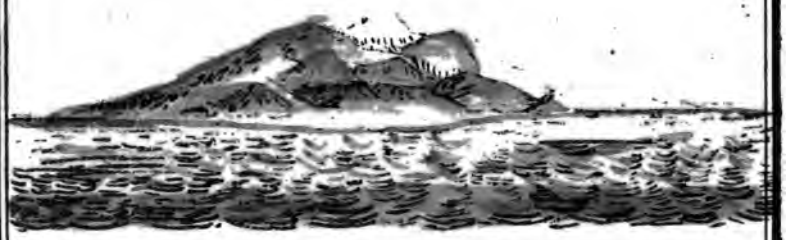

Volcano of Gibbel-Teer, Red Sea, about 500 feet high: still active,—
the northernmost of the Red Sea Group

Mud Volcano—one of the koops of Chundra—near Beila, Beloochistan.

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Volano of Barren Island, Bay of Bengal, about 500 feet high: still active.—Copied from *Lyell's Geology*.

Supposed Section of Barren Island: the brown portion still remains—the rest blown awa by explosion or removed by denudation.

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PLATE VI.

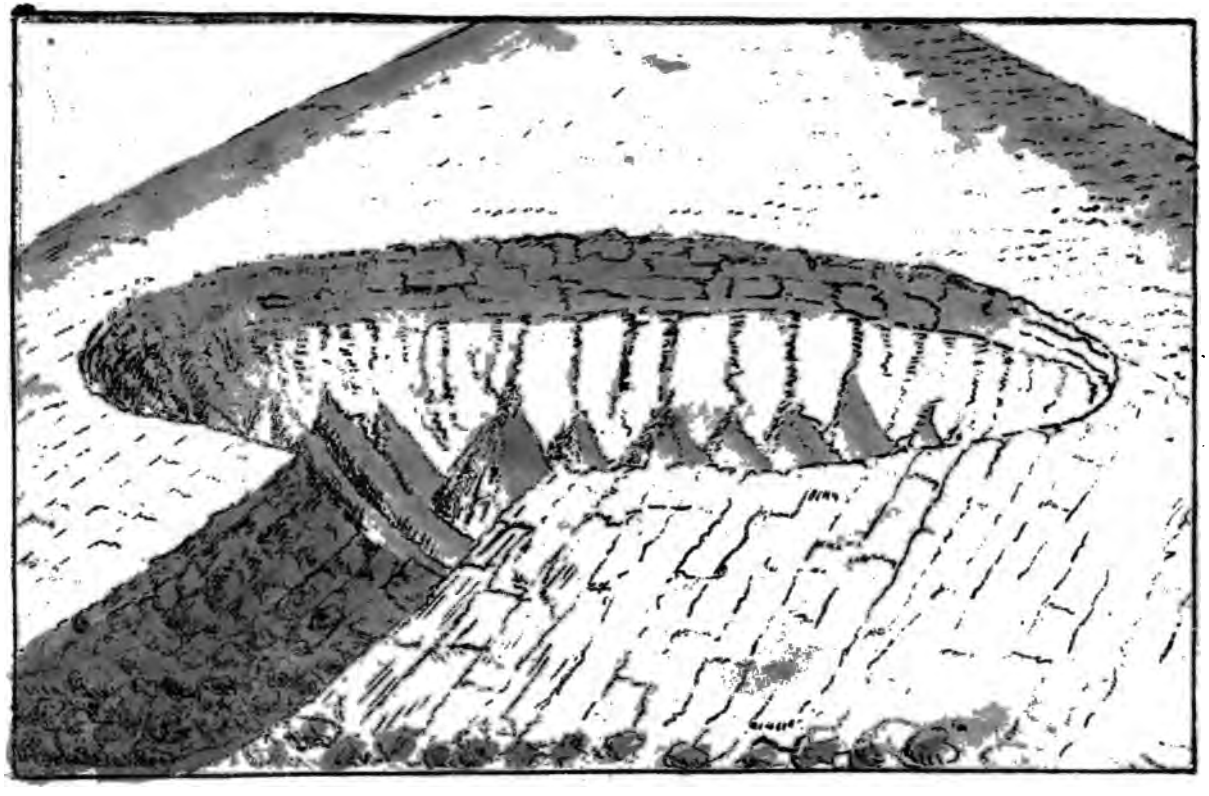
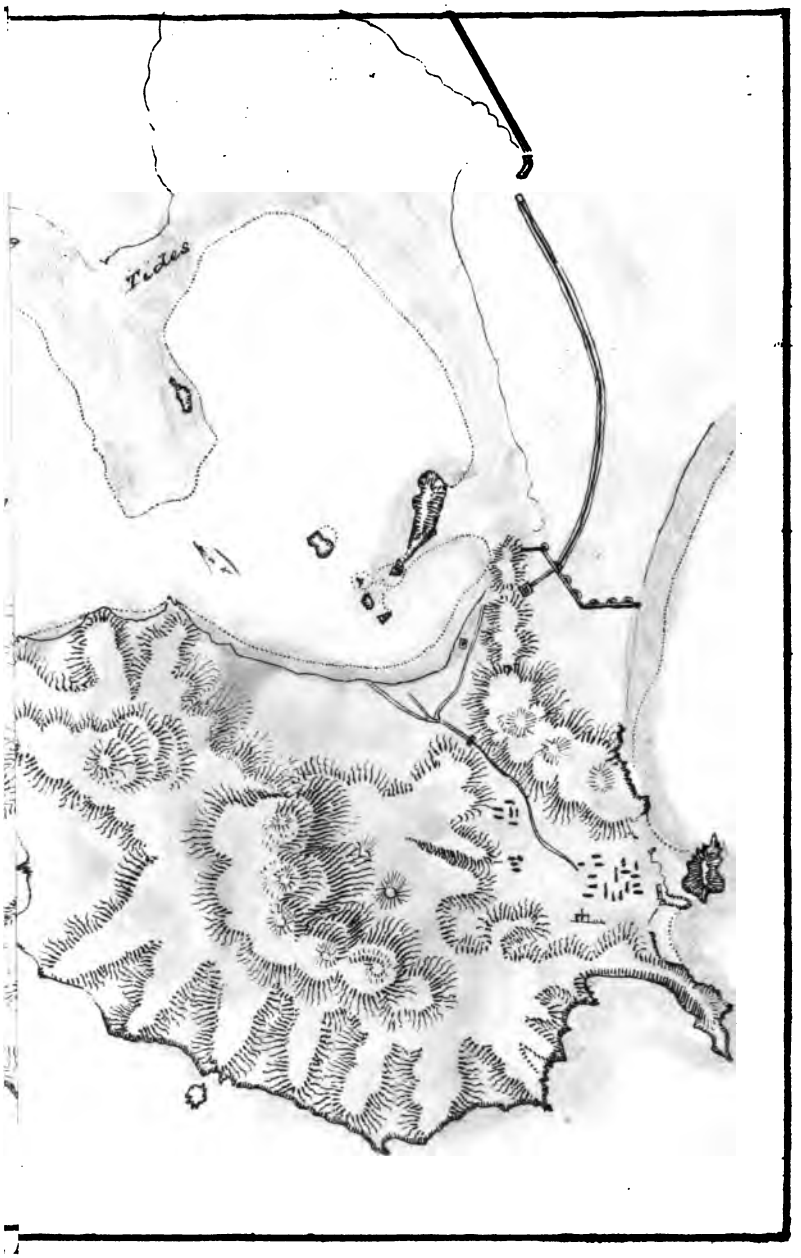


PLATE VIII.

[illegible] Hill, showing the disrupted strata and the conical mass of rubbish [illegible]

PLATE IV



...elves are all lavas of various descriptions, more or less ...diversity of igneous minerals. There seem to have been ...n the mountain, one of very considerable magnitude ...lf-it and Ras Tar Shagan, having been blown outwards, ...to om the sea. The edge of the principal crater is near ...self occupies the eastern half. It is exceedingly well ...ch in to the spectator. It is about one and a half ...fewing a circuit of five miles. Of this half a mile has ...e filli sea. The bottom of the crater on which stands ...he la..., is covered with a bed of rolled gravel and sea ...been *irruption since* the last general upheaval, which

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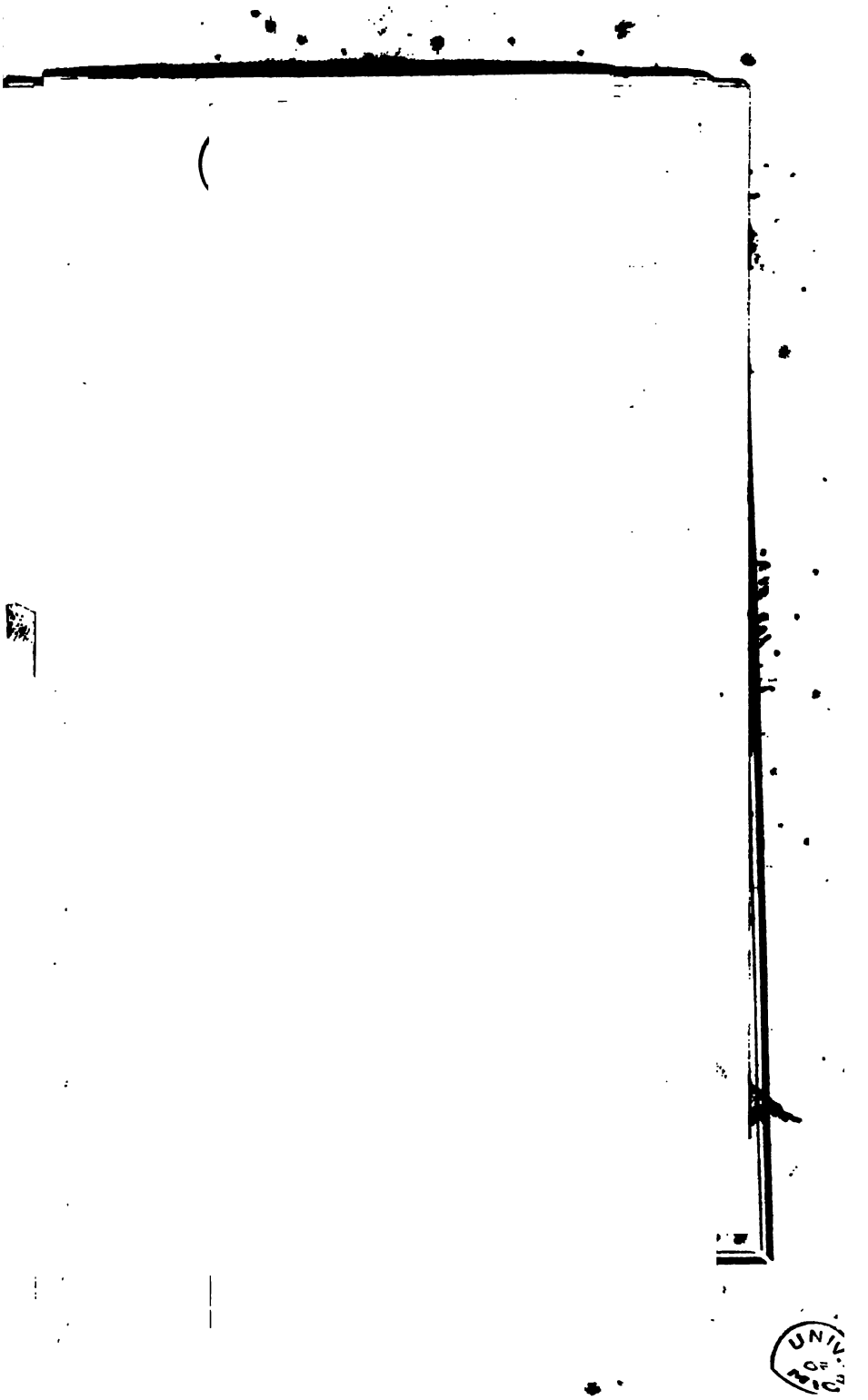

Crushed-up strata of blue shale, in the large tank, Matoonga.

Stratified shale with masses of trap embedded.

1 Shale.
2 Amygdaloid.

Crushed strata in beds of blue shale over amygdaloid.—Parell Gardens.

1 Shale.
2 Amygdaloid.

Globular trap, much decayed. Railway cuttings, Mahim Road.

Trap boulders embedded in shale. Sea-shore, Sewree.

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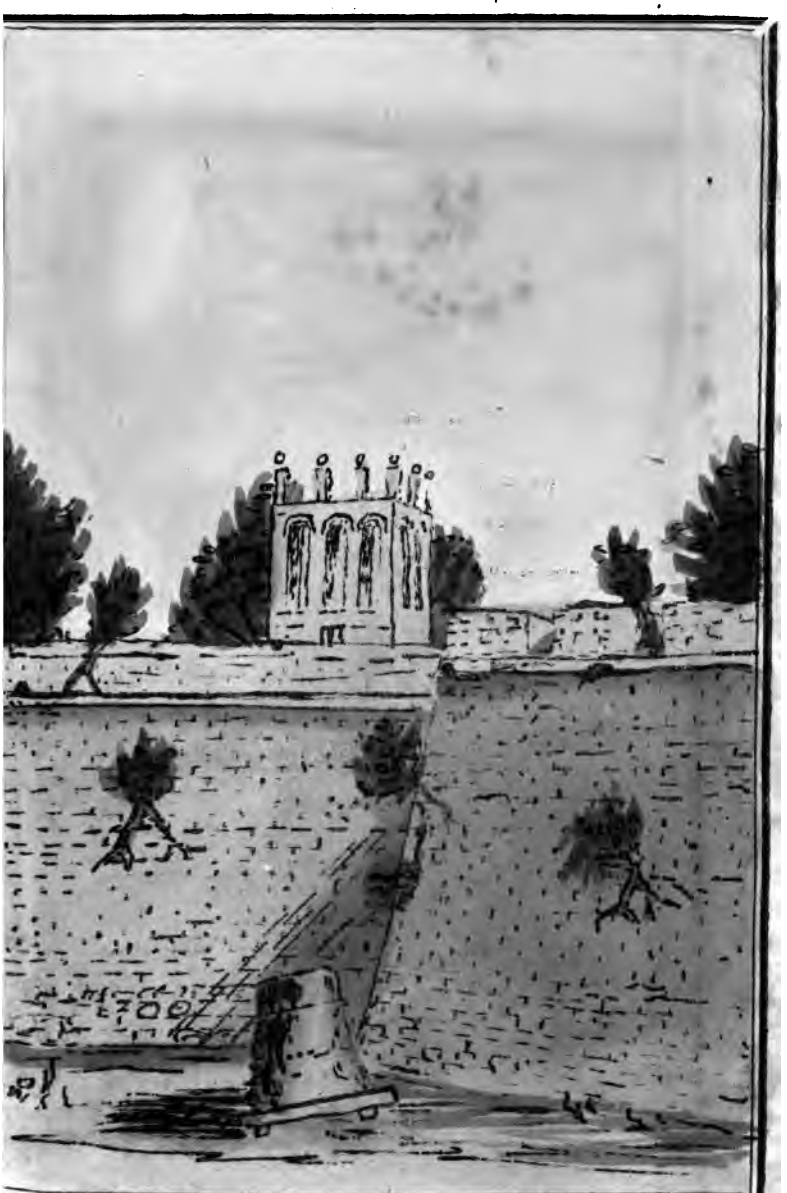
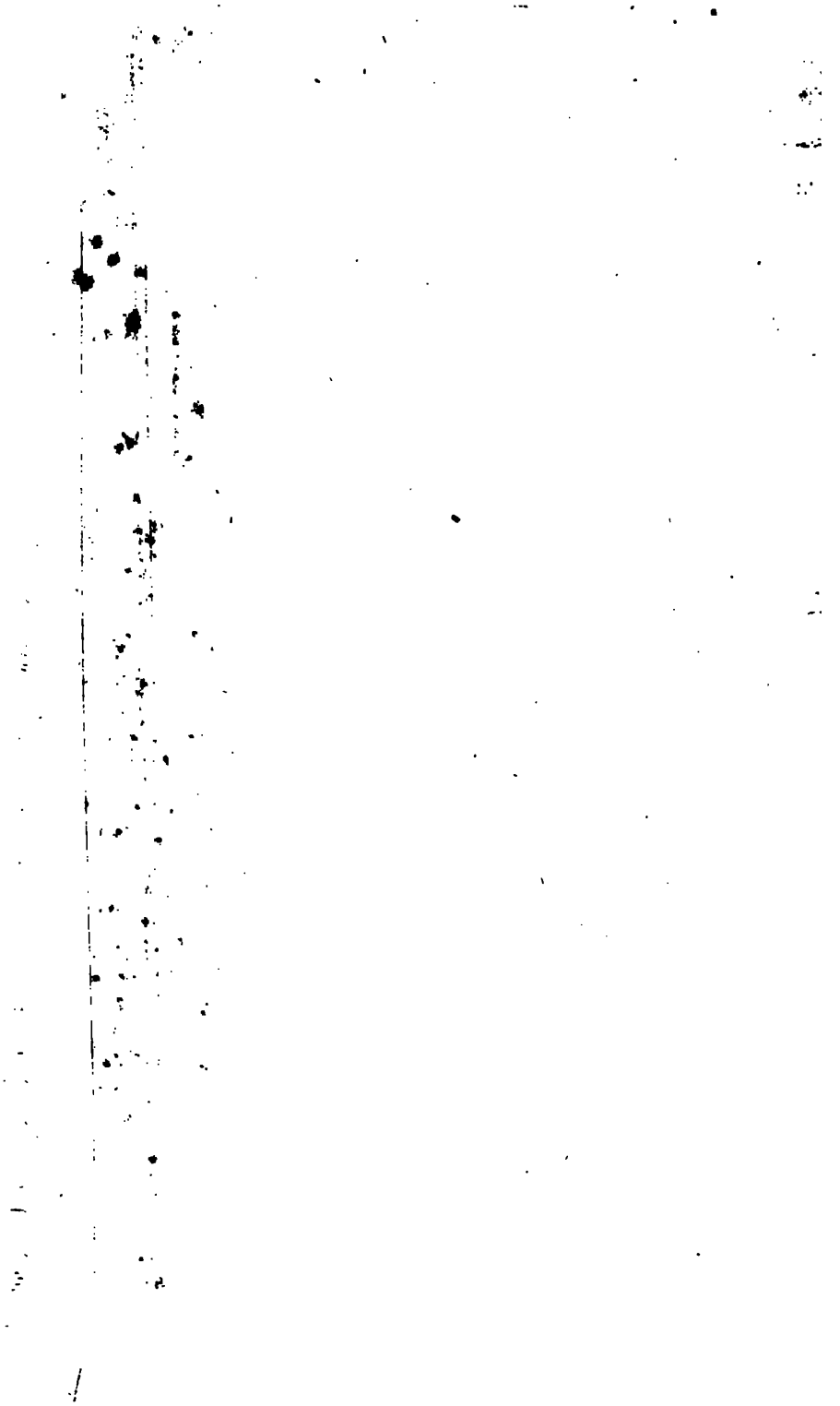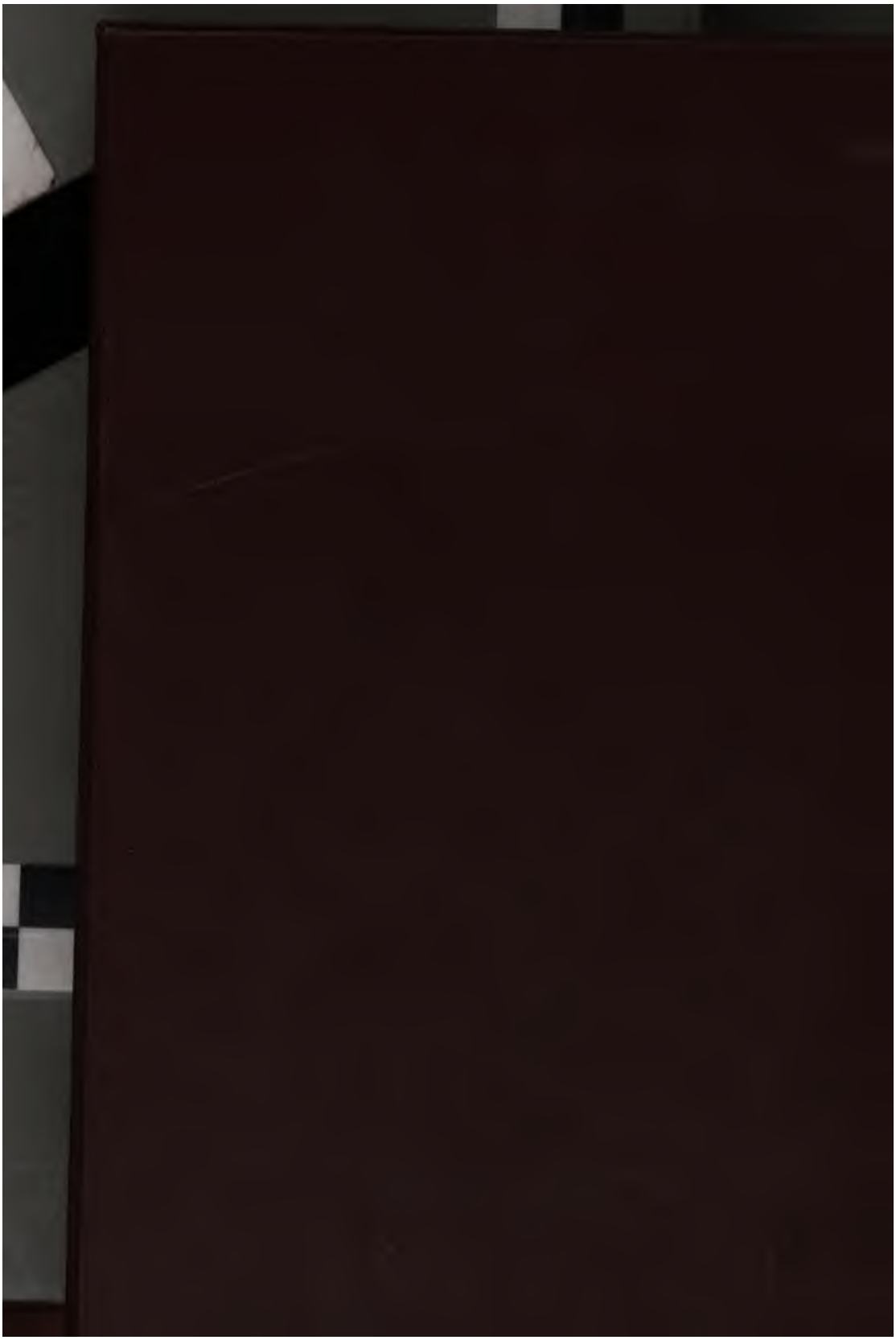
Encroachments of the sea on the Portuguese city of Bassein. Six feet of the foundation of the wall is now exposed, which must have been originally under ground: a tank eleven feet in diameter and sixteen feet in depth, has been left standing like a gigantic cask, the lower end exposed—fourteen feet of ground washed away.